THE Journal OF THE
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Volume Fifty-Four

PRECONVENTION AND ORTHOPEDICS NUMBER

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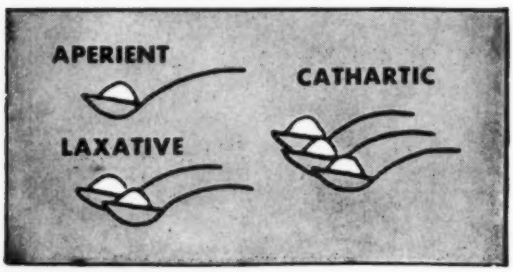

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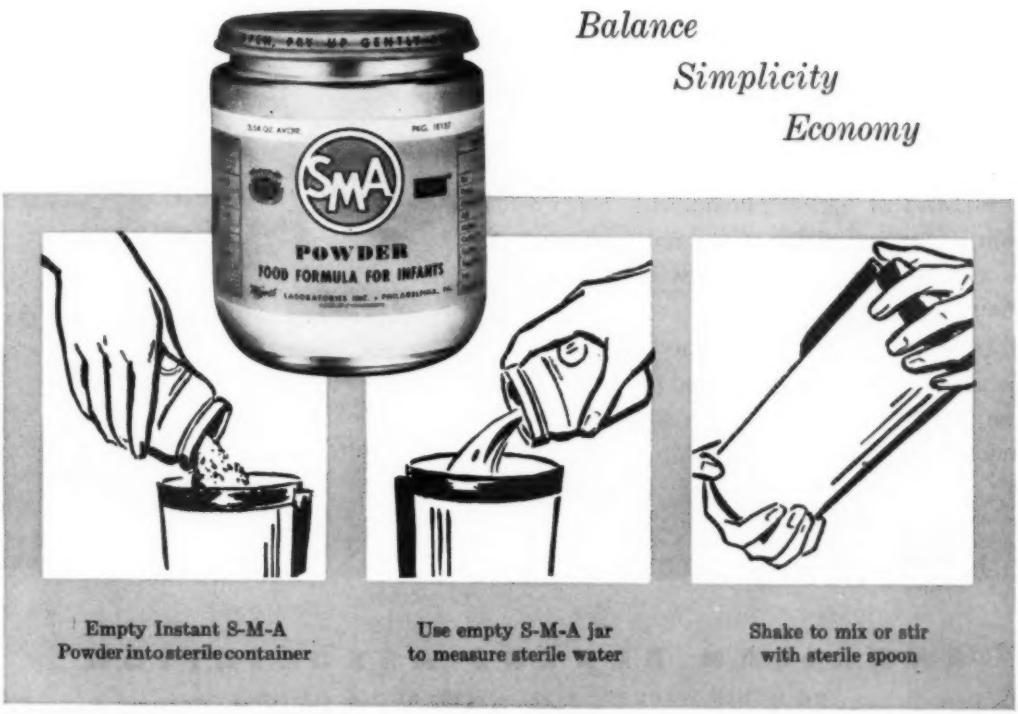

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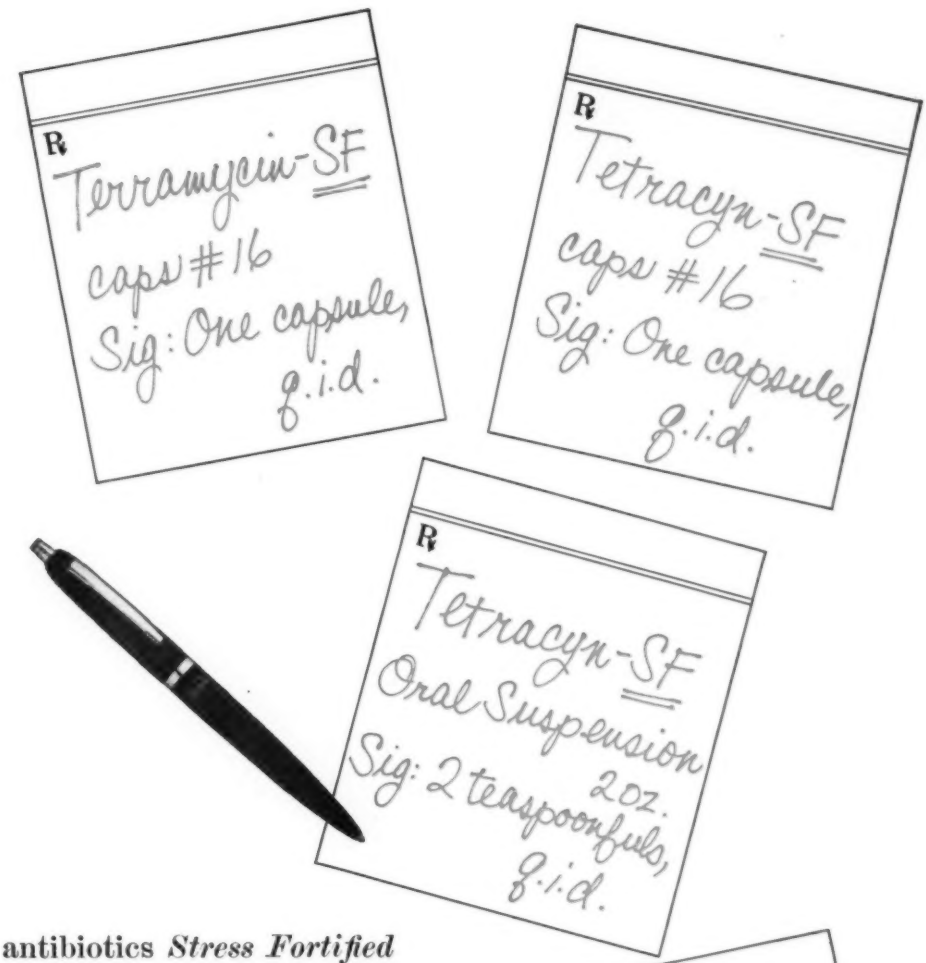

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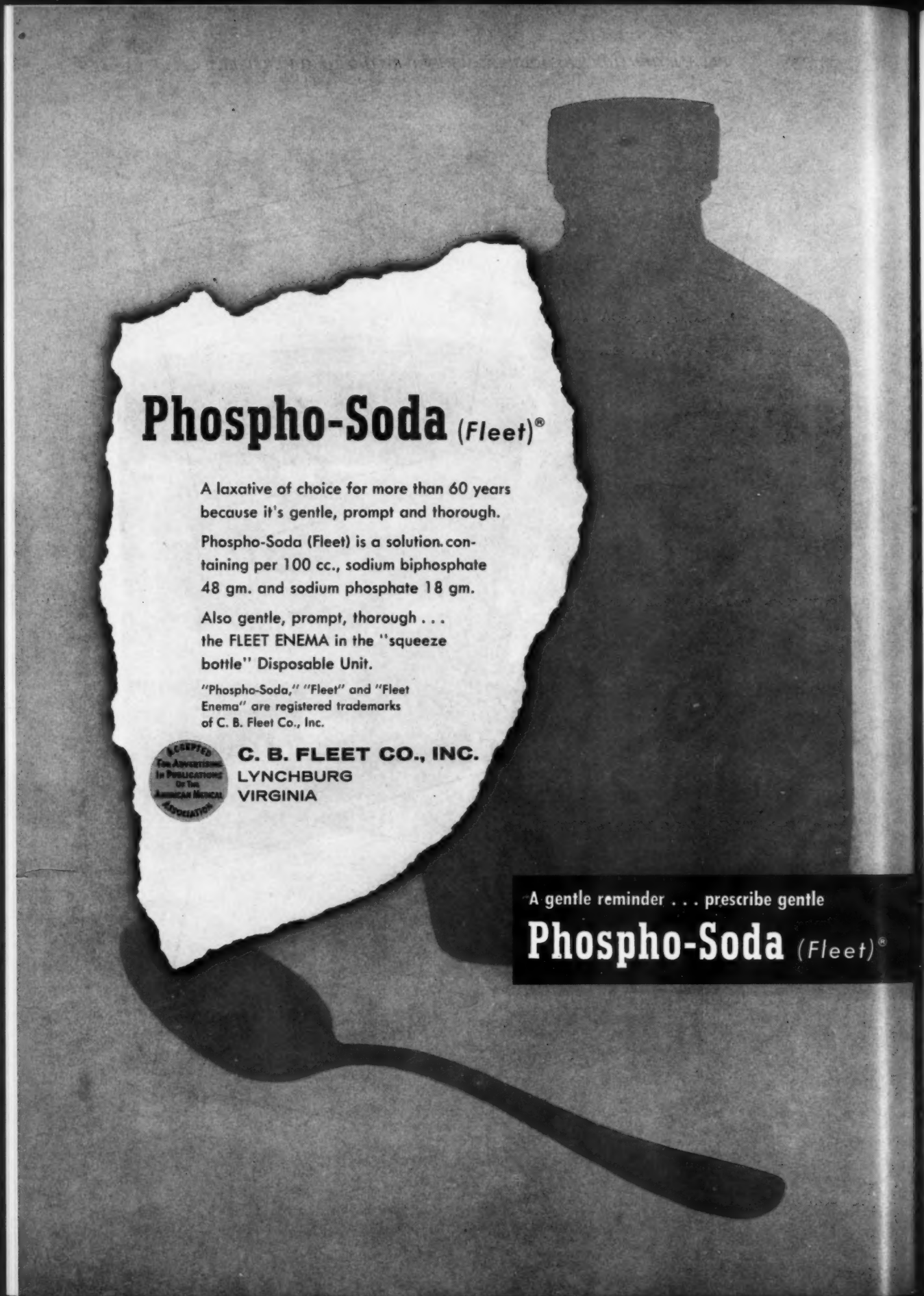
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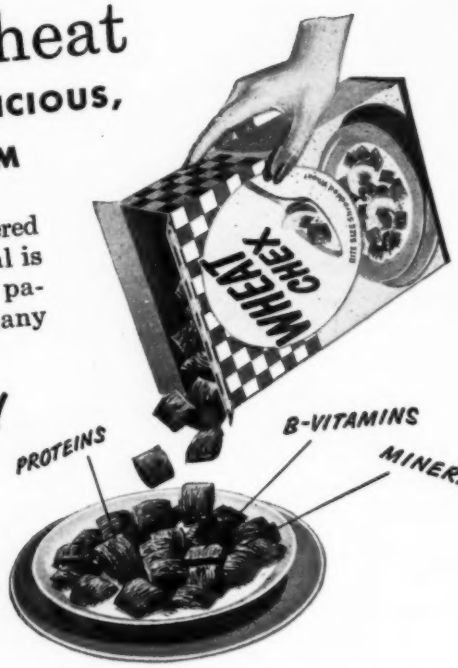

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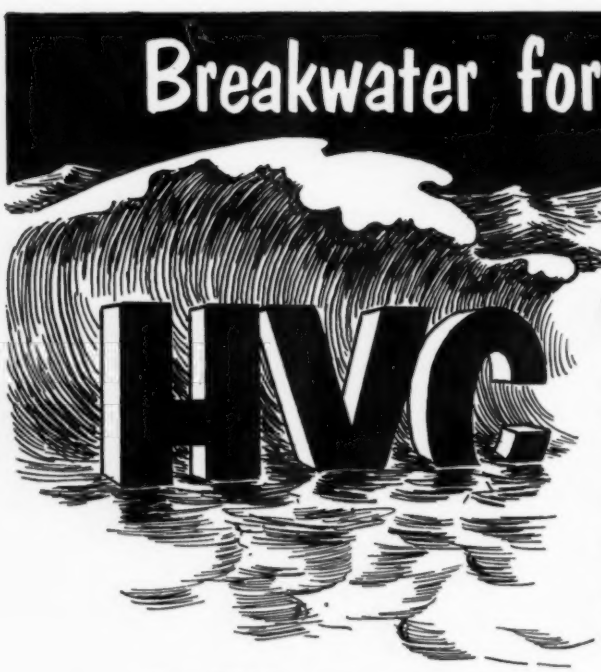

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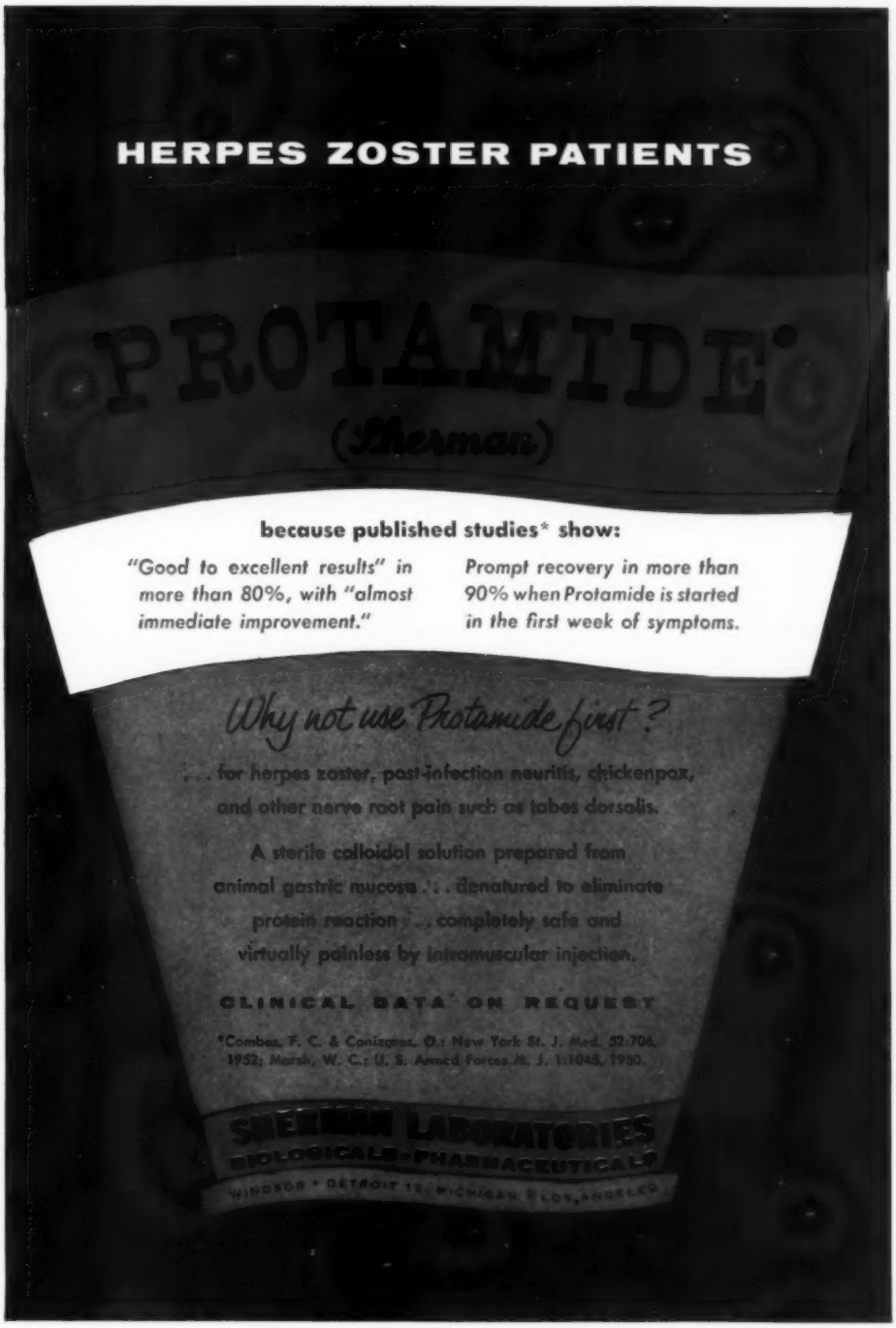
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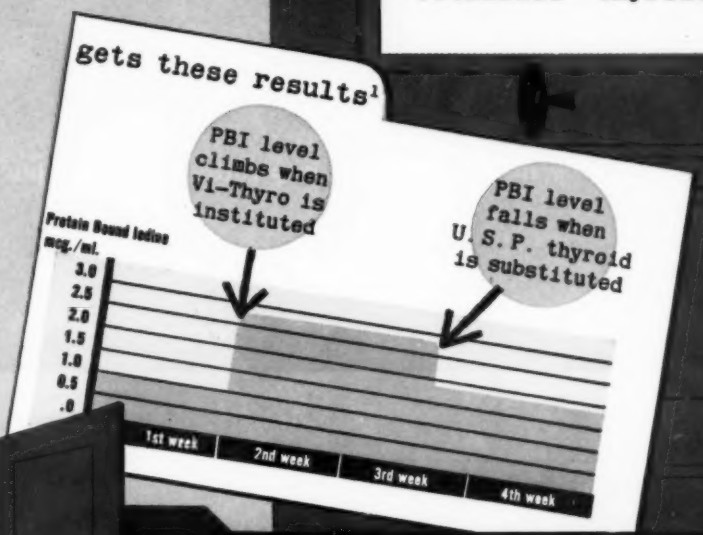

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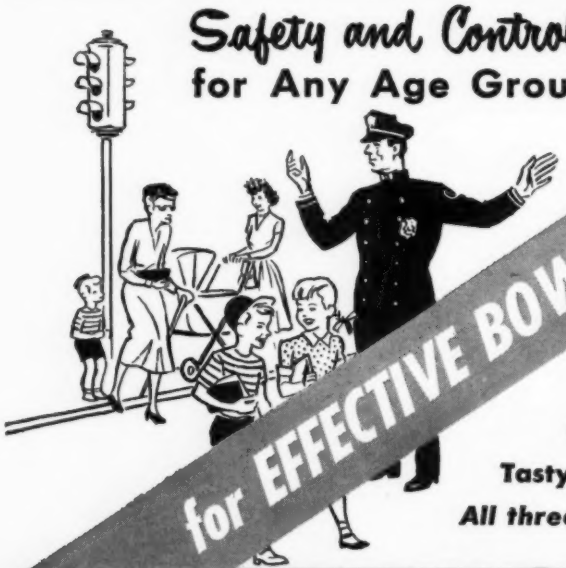
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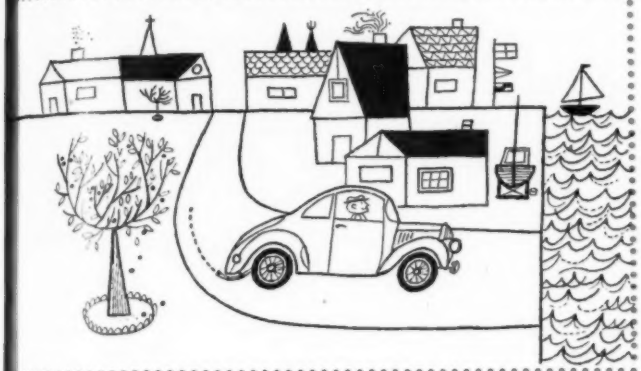

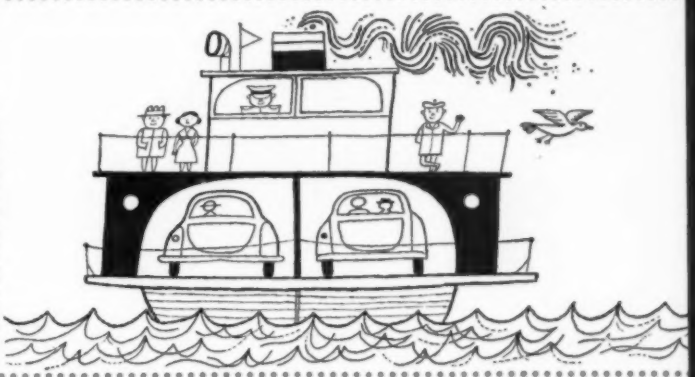

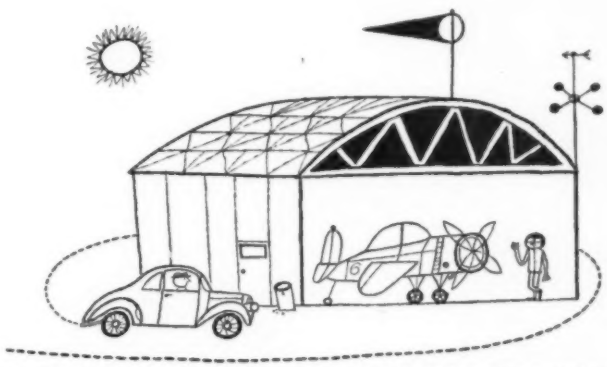

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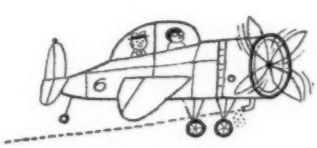

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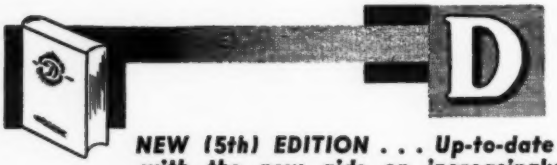

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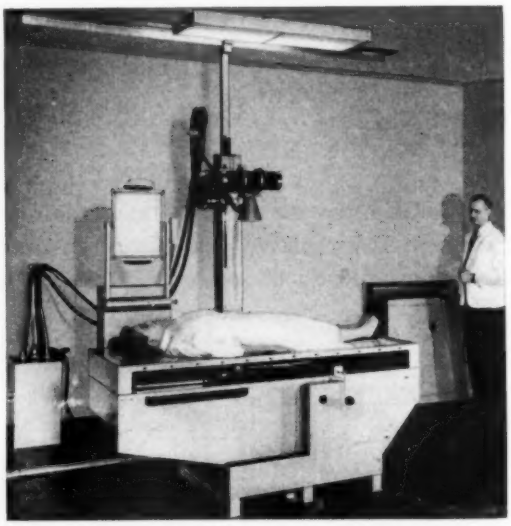

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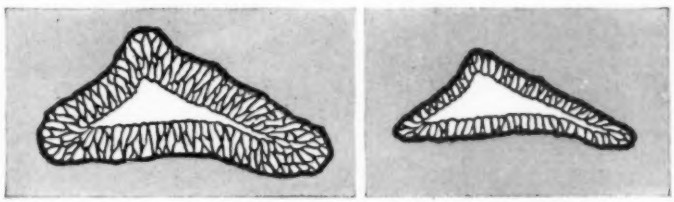

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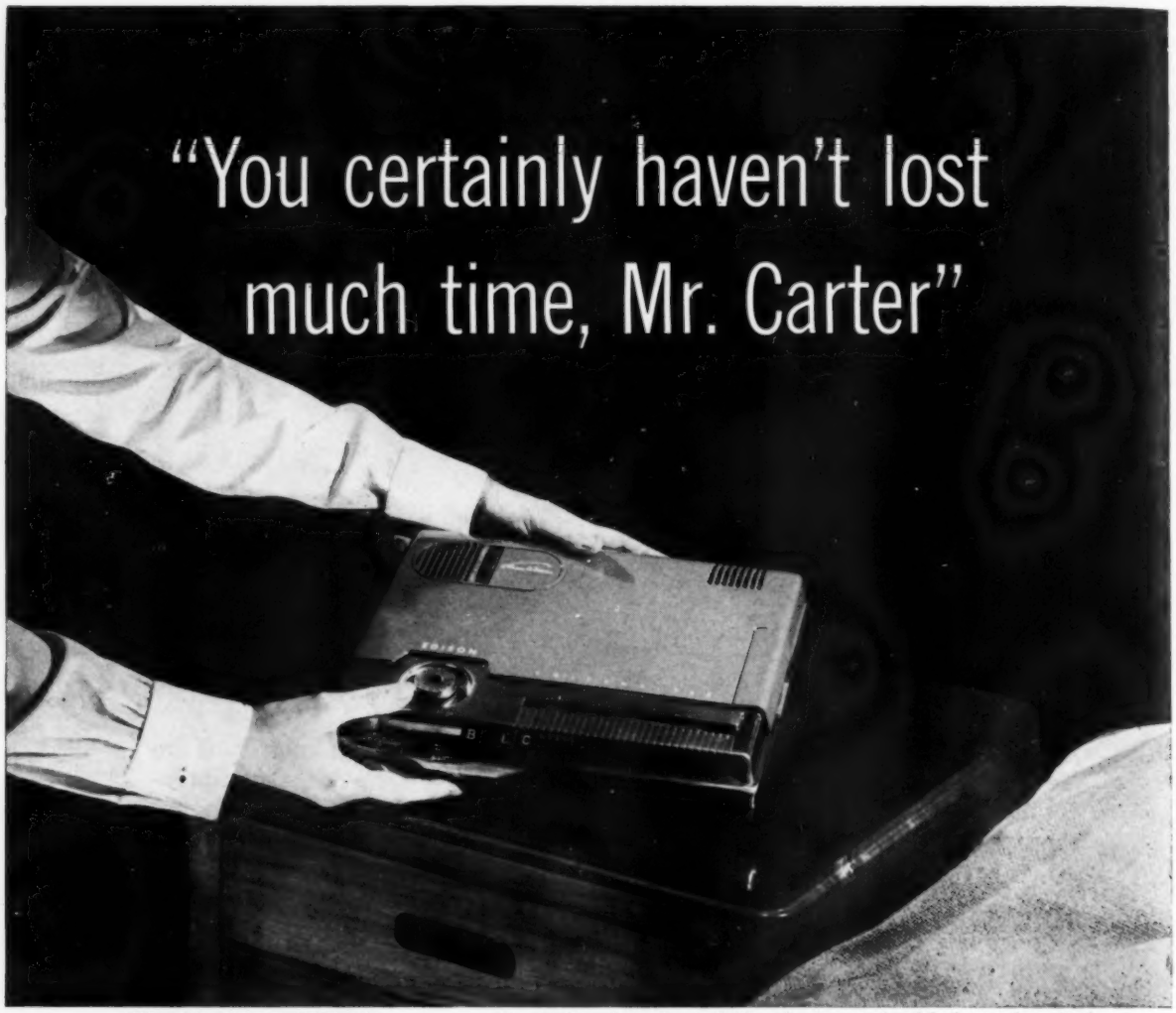

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The Problem of Muscle Hypertrophy: A Review

PHILIP J. RASCH, M.A., M.Ed.

Assistant Professor,* Department of Physical Medicine and Rehabilitation
College of Osteopathic Physicians and Surgeons
Los Angeles

INTRODUCTION

In a previous paper by Rasch and Freeman,[1] narcissistic gratification was accepted as a legitimate goal for therapeutic exercise in a neuropsychiatric hospital. It was pointed out that such gratification could be achieved in two ways: by increasing skeletal muscle strength and by increasing skeletal muscle hypertrophy. The physiologic principles underlying the rationale of the use of progressive resistance exercise to increase strength were considered in an earlier paper.[2] It is the purpose of the present study to review what is known of the physiology of hypertrophy.

DISCUSSION

All three types of muscle are capable of hypertrophy. Striated muscle may increase in size after exercise; the smooth muscle of the uterus may hypertrophy in response to ovarian and placental estrogen and progesterone during pregnancy; when increased loads are placed upon the heart, it may respond by growing, possibly as a result of the distention caused by the exercise. In the following discussion, only striated muscle will be considered.

There are two possible ways to approach the problem. One is to examine what is known about hypertrophy; the other is to review the findings that have been made in studies of atrophy on the assumption that reversal of the factors displayed in this condition might result in hypertrophy. While a great number of studies of atrophy have been reported in the literature, most of them represent findings after experimental denervation. Since Reid[3] has pointed out that the muscular changes in denervated cats do not proceed identically with those in disuse atrophy, great care must be used in applying such findings to subjects in which innervation remains intact. In this paper reports of studies of atrophy will be restricted to those resulting from disuse.

Regardless of which approach to the problem is utilized, considerations of muscle anatomy and physiology remain basic. According to Tracey[4] each of the fibers composing a skeletal muscle is made up of a single cell containing fibrils running along its length. The muscle fibers present a striped appearance under the microscope due to alternate light and dark bands. The dark bands shorten when the muscle contracts; if the muscle is not allowed to shorten, the light bands lengthen to compensate for the contraction of the dark ones. The basis for muscular contraction thus lies in the action of these banded fibrils, and it has been shown that they are composed of myosin.

Englehardt and Ljubimowa[5] found it impossible to separate adenosine triphosphate from myosin, and reported:

> We are led to conclude that the adenosinetriphosphatase activity is to be ascribed to myosine, or, at least, to a protein very closely related to and at present not distinguishable from myosine. Thus the mineralization of adenosinetriphosphate, often regarded as the primary exothermic reaction in muscle contraction, proceeds under the influence and with the direct participation of the protein considered to form the main basis of the contractile mechanism of the muscle fibre.

Since the amount of extractable myosin depends on the amount of myofibril substance present, ". . . the conclusion is inescapable," write Adams, Denny-Brown, and Pearson,[6] "that physiologic activity can determine an increase in number of myofibrils."[6] This is confirmed by Chor and Dolkart's[7] report that loss of muscle bulk is not accompanied by any degeneration of muscle fibers or of the anterior horn cells of the origin of the nerve supply involved.

Chemically, muscles are composed of approximately the following portions:

Water	75%
Proteins (myosin, globulin X, myogen, myoalbumin, et cetera)	20%
Carbohydrate	1%
Fat (cholesterol, phospholipins, et cetera)	2%
Inorganic salts	1%
Miscellaneous (nitrogenous extractives—creatine, urea, et cetera, non-nitrogenous extractives—lactic acid, pigments, enzymes)	1%

In a striated muscle, about 60 per cent of the protein is globular myosin. It is generally considered that this represents the contractile portion of the muscle. The myosin is nearly a gelatin, kept in solution by what is practically an isotonic solution of potassium. When a fiber is stimulated, it loses some of its potassium and gains sodium; in recovery this process is reversed. The chemistry of muscle contraction may consist of the re-

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lationships existing between myosin, potassium, and adenosine triphosphate. If it is accepted that fibrous protein is responsible for contraction, then a folding of the myosin chain would seem to be the direct step leading to muscle contraction and thus a conversion of chemical potential energy into mechanical energy.[8]

The cycle of muscular contraction and relaxation has been summarized by Szent-Gyorgyi[9] as follows:

1. A message is sent out by the central nervous system.
2. It is received in the muscle by the nerve ending.
3. A local depolarization of the membrane of the muscle fiber is generated.
4. This turns into a self-propagating "wave of excitation."
5. A "window field" (electrical field) results.
6. This interacts with intracellular cross structures and ions.
7. A disturbance of the ionic balance is produced.
8. The actomyosin system goes through the cycle of contraction.
9. The energy spent is restored by oxidation and fermentation.

"If," said Szent-Gyorgyi,[9] "the complexity of the system oppresses the biologist, it must entirely paralyze the pathologist. . . ."

In recent years workers have been seeking in the changes associated with the metabolites of exercise or their oxidative removal for an adequate explanation of the stimulus to hypertrophy in muscle.

Fenn and others[10] studied in detail the electrolytic changes which take place in cat muscle during stimulation. Their results may be summarized as follows:

1. There is a loss of potassium, which is balanced by a gain in sodium.
2. There is a further gain in sodium, which is balanced by a gain in chloride.
3. This is approximately equal to the gain in total base.
4. There is a gain of water, which is greater than the gain in isotonic sodium chloride solution.
5. There is no significant change in calcium or magnesium.
6. There is a probable slight loss in total phosphorus.
7. There is a slight increase in phospholipid, which is greater than would be expected from the infiltration of plasma containing phospholipid.
8. There is no change in cholesterol.

After a recovery period of a few hours, there is a more or less complete reversal of these changes.

Certain definite changes take place in exercised muscle. Physically, the sarcolemma becomes thickened and toughened and the amount of connective tissue increases. Chemically, there is an increase in the phosphocreatine content, a larger amount of glycogen is laid down, and the quantity of non-nitrogenous substances increases. Holmes[11] advanced the theory that the establishment of chemical equilibrium may be a dominant factor. He suggested:

> If the checking of the growth and functioning of an organ when its products reach a certain degree of concentration is due to the fact that a chemical equilibrium is reached which prevents more of these substances from forming, the self-regulation of functions which goes on in an organism may be to a great extent the outcome of the tendency toward chemical equilibria. . . . If a particular substance is gotten rid of with more than the usual readiness, we should expect that substance to be produced in increased amount.

This, Holmes suggested, would often lead to an increase in the development of the organ or part concerned, although he acknowledged that it is unlikely that functional hypertrophy can always be explained in so simple a manner.

The gain in water in exercised muscle mentioned by Fenn[10] has been frequently suggested as a factor in muscle hypertrophy. According to Hawk,[12] as long ago as 1865, Ranke observed that "working muscles are richer in water than resting ones, and that the greater the activity of the muscle, the greater the water content." However, a longer period of muscular stimulation does not necessarily have a greater effect in this respect than a shorter one. Scott, Herrmann, and Snell[13] found that in about half of their subjects the concentration of blood due to the passage of fluid from the blood to the muscles was greater after 2 minutes of muscular contraction than it was after 10. They attributed this to the passage of the products of activity from the muscle back into the blood with the consequent tendency to restore osmotic equilibrium and noted, "It will be remembered that those . . . who have studied the effects of exercise on the blood of man found greater effects from short exercise (100 yards) than from the longer runs."[13] It might be noted that the current trend toward practicing progressive resistance exercises in heavy resistance-low repetition sets rather than with low resistance and high repetitions, finds some theoretical justification in this regard.

Some physiologists believe that a positive water balance is a factor in athletic training and muscle hypertrophy, and in many weight-training gymnasia the drinking of large amounts of water during workouts is encouraged. However, since Boyle and Scott[14] determined that the "amount of fluid entering the muscles would hardly increase their water content by 1 per cent . . . ," it seems questionable that increased water content could have any important effect on muscle hypertrophy.

The whole question of the influence of tissue fluid formation has been summarized by Wright.[15] He noted that in muscular activity the weight of the muscle may increase by 20 per cent and suggested that the factors concerned include:

1. Increased blood flow
2. Increased arteriolar pressure
3. Capillaries in the active region open and become widely dilated
4. Osmotically active metabolites attract fluid from the blood and return it in the tissue spaces.

This provides a theoretical basis for the emphasis in weight-training gymnasia on "muscle flushing" to produce hypertrophy.

On the other hand, when Imig, Randall, and Hines[16] immobilized the hind limbs of dogs, testing after 14 days showed that an increased blood flow had resulted during immobilization. The authors stated that the increase in temperature was not sufficient to cause an increase in blood flow and suggested that immobilization may be accompanied by a reduction of vasoconstrictor tone.

Hough[17] reported that measurements of girth of the forearm following rhythmic contractions showed at times an increase and at other times no change at all. He remarked:

> Loeb has shown, moreover, that when an excised muscle has been thrown into activity the osmotic tension within the muscle fibre increases, as is shown by its increase in weight when placed in a solution of sodium chloride isotonic with the

contents of a resting muscle. It would seem, in view of these facts, that until the blood and lymph currents are able to remove the diffusible wastes from the muscle, there must be more or less oedema in the organ.

Starkweather[18] suggested that changes in girth and volume of the arm after exercise result from "temporary, local vaso-motor changes, which disappear as soon as a readjustment of the excitable tissues to the new conditions is established." In her experiments with young college women, increases in arm girth resulting from simple flexion and extension with a 2.5 kilo weight always disappeared entirely if the exercise was continued long enough (30 to 40 minutes). However, her findings are to some extent contradicted by those of Boyle and Scott.[14] They recorded increases in arm girths of young men after turning a friction wheel. Twenty-four hours later six of the arms were still somewhat enlarged, five were normal, and one was definitely smaller.

According to Wakim,[19] Petren, Sjostrand, and Sylven believe that hypertrophy of muscle is due to an increase in the number of capillaries resulting from repeated exercise. They noted an increase of about 45 per cent in the number of capillaries in guinea pig muscles during exercise as compared with those not exercised. Krogh[20] compared an active muscle of one side of the body with the corresponding muscle inactive on the other side and found that in the active muscle the number of open capillaries might range from forty to one hundred times the number in the resting muscle. The precise causes of this capillary dilatation is not understood, but the general effect is as might be expected from the fact that Davis and Brewer[21] found that during a period of exercise the blood volume, total cell volume, and erythrocyte count of their dogs exceeded the normal. Precisely the opposite development occurs in cases of bed rest. Taylor and others[22] found that in five young men kept in bed for 3 weeks there was an average decrease of 9.3 per cent in the total circulating blood.

More detailed studies in this connection were made by Deitrick, Whedon, and Shorr,[23] who immobilized four young male subjects for 6 to 8 weeks by pelvic girdle and lower extremity casts. Their findings may be summarized as follows:

Girth Decreases		
Upper arms		2%
Forearms		2%
Thighs		2.1-5%
Calves		5.5-6.3%
Cross Section Area Decreases		
Cross section of thighs		4.2-10%
Cross section of calves		9.7-12.5%
Strength Decreases		
Biceps		6.6% average
Shoulder and arm		8.7% average
Anterior tibial group	13.3% average (7.8-20.6)	
Gastrocnemius-soleus	20.8% average (11.8-31)	
Grip		Insignificant
Abdominal and back muscles		Insignificant
Blood Volume Decreases		
Plasma average	191 cc.	6.3% average
Total blood volume	275 cc.	5.4% average
Body Weight Changes		
Loss or gain		—0.7 to +1.6 lbs.

In a similar experiment by Chor and Dolkart,[7] using rhesus monkeys instead of human subjects, it was found that in 10 weeks there was a decrease in the bulk of the gastrocnemius-soleus of 32.5 per cent. Such losses seem far greater than would be expected from Hines and Wehrmacher's[24] conclusion that during acute inanition the gastrocnemius muscles of cats, rats, and guinea pigs undergo atrophy at a rate which closely parallels the loss of total body weight.

Knowlton and Hines[25] found that when rats were placed on a fast, a loss of over 40 per cent of the body weight resulted in death of the animal; however, in weight losses of as much as 38 per cent, the muscle cell phase remaining retained its normal strength. Conversely, Adams, Denny-Brown, and Pearson[26] stated that "Training of normal muscles to induce hypertrophy does not increase muscle power per unit of weight."

Studies by Morpurgo[27] have shown that exercise does not increase the number of muscle fibers, although it may call into use many fibers which have remained undeveloped because there had been no previous demand for their services. It is a matter of common observation that similar exercise dosages do not produce identical results with different subjects. In part, at least, a muscle's ability to respond to increased demands by hypertrophying must be based upon potentials carried in the germ plasm.

It has long been known that bed rest results in a negative nitrogen balance. Keys[28] stated that "This phenomenon would seem to be a kind of disuse atrophy; probably most of the nitrogen lost comes from the muscle cytoplasm. . . ." Weech, Wollstein, and Goettsch[29] maintained thirty-eight dogs on low protein diets for periods of 21 to 108 days. They found that after 3 months, the relative cell volume was 72 per cent of the initial level. After 80 days, the total volume of circulatory erythrocytes was 53 per cent of the initial level, and the total cell volume was about 68 per cent of the initial level. Pollack and Halpern[30] stated that "evidence of muscle atrophy is indicative of prolonged severe protein deficiency."

Unfortunately, the details of the manner in which the animal maintains protein equilibrium are not well understood. It is generally agreed that in short, strenuous bouts of exercise, the main source of fuel for muscular work is carbohydrate; in prolonged exhaustive exercise, fat may be used after the carbohydrate stores have become depleted. Protein does not seem to be used except in minimal amounts for the performance of muscular work as long as either of the other two foodstuffs is available. Muscular exercise may be varied greatly with no appreciable effect on the amount of nitrogen secreted, provided that the stores of carbohydrate and fat have not been exhausted.

To study the effect of pure disuse atrophy on nitrogen metabolism, Cuthbertson[31] confined healthy volunteers in bed with one leg in a splint. An almost immediate rise in the output of urinary nitrogen resulted. Cuthbertson remarked that it is "very curious" that both moderately severe work and prolonged bed rest result in an increased output of nitrogen.

Cathcart[32] pointed out that in spite of theoretical arguments for carbohydrate as the main source of muscular energy, most training programs, ancient and modern, have laid particular stress on protein and have tended to reduce the carbohydrate intake. Further, when free choice is offered, men doing regular hard muscular work tend to select a relatively high protein intake. He suggested that when sufficient carbohydrate is present, the actual disintegration of the protein is largely masked by the resynthesis which takes place during exercise and that the nitrogenous materials

which would normally have been excreted are retained in the muscle to make good the activity loss. He cited the work of Bornstein and others, who have studied the special hypertrophy of muscle with the associated retention of nitrogen which takes place when muscle work is done.

Actually, studies to date have failed to demonstrate that changes in the protein intake have any effect on work ability. In a project reported by Darling and others,[33] over a period of 8 weeks no beneficial or harmful effect could be observed on the physical vigor or efficiency of healthy young men subsisting on a diet adequate in calories but restricted to 50 to 55 gm. of protein daily, very little of which was of animal origin, or of those subsisting on a diet providing 160 gm. or more of protein daily.

Nevertheless, body builders have recently begun using large quantities of dietary supplements consisting principally of proteins. Claims of excellent results in developing muscular hypertrophy have been made, but there seems to be no record of tests under controlled conditions.

It is interesting to note that in experiments in which Bigland and Jehring[34] injected Norway rats with pituitary extracts, the quadriceps of the treated animals became 20 to 30 per cent heavier and had a cross-sectional area 6 to 12 per cent greater than did those of the untreated animals, but that this did not confer any functional advantage. The treated muscles gave less tension per gram of muscle weight than did those of the controls.

Cotes, Reid, and Young[35] found that daily administration of ox anterior pituitary tissue induced diabetes mellitus in the adult dog or cat. They suggested that this was a property of the protein hormone itself and . . . probably the pathological result of an excessive stimulation of these processes (inhibition of oxidation of carbohydrate with enhancement of protein storage and fat combustion) which under more physiological conditions lead to such deposition of new tissue as is associated with growth.

CONCLUSIONS

Little is known of the basic mechanism underlying skeletal muscle hypertrophy, and the manner in which functional activity reacts to produce growth has not been determined. The conclusion to which studies of the subject seem to point is that hypertrophy results chiefly from an increase in the quantity of sarcoplasm to be found in the individual muscle fibers. Sarcoplasm is composed largely of protein, and there is some evidence to indicate that an additional amount of protein is deposited in the muscles during periods of activity. However, it has been reported by different observers that in both moderately severe work and in prolonged bed rest there is an increase in protein catabolism. The sweeping claims that have been made for achieving increased hypertrophy by the addition of protein supplements to the diet have not, to date, been supported by reports of controlled experiments. Such studies as are to be found in the professional literature do not demonstrate that any increased physical vigor or efficiency results from the use of such dietary supplements.

Animal experiments with the administration of pituitary extracts have resulted in increased hypertrophy without any accompanying functional advantages. A review of the literature relating to strength and to hypertrophy has thrown very little light on the relationship which exists between increases in hypertrophy and increases in strength, but it seems unlikely that any simple, direct correlation exists. It is possible that this results from the fact that, in part, increases in hypertrophy may be due to increases in the number of capillaries and quantity of fluids in exercised muscles, and these do not contribute directly to increases in strength.

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The Use of Ultramicro Biochemistry in the Clinical Laboratory

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There appears to be some reluctance on the part of clinical laboratories to use ultramicrochemical technics, owing probably to the assumption that these are methods of the research chemist only. It is true that very great precision is required and that slovenly technic yields unreliable results; however, ultramicrochemical apparatus is now commercially available, and most of the procedures have been adapted to standard electrophotometers. All of the methods to be described use blood taken from the fingertip or, in infants, from the heel.

With the exception of the Byrd blood sugar technic, the methods are those of Natelson.[1-3] We have used the total protein, nonprotein nitrogen, blood sugar, and urea nitrogen procedures in our laboratory for some time and have had accurate results.

Chloride, carbon dioxide, sodium, and potassium estimations require special apparatus and a flame photometer. We have only recently acquired this equipment, but our results have so far been consistent and compare favorably with macrodeterminations.

SAMPLING

The critical step in the analysis is the sampling of the specimen. This has been worked out to the point where it is now as simple as sampling with usual technics. Ultramicro-pipets are commercially available.

The tube into which the sample is drawn is made from ordinary glass tubing having a bore of 1.5 mm. and an outer diameter of 2.8 mm. Heat the tube in a glass flame and draw out the tip to approximately 0.8 mm. Break at the tip with a file, and fire polish both ends. In order to coat its walls, before using the pipet draw up an anticoagulant into it and then expel. Repeat this procedure leaving a small amount in the tip the second time.

After the finger or heel puncture is made, hold the collection tube in a horizontal position allowing it to fill by gravity and capillarity. Apply cement to the wide end of the tube. A downward snap of the wrist will drive the blood to the bottom of the tube, mixing blood with the anticoagulant. Approximately 10 cm. of blood are drawn into the tube and several determinations can be made with this single sample. We have used heparin as an anticoagulant. For centrifugation the narrow sampling tubes are placed in ordinary test tubes and centrifuged at 2,000 r.p.m.

To obtain serum, plasma, or cells from the sampling tube, scratch the tube above the plasma level with an ampule file, then break off and discard the tip of the tube. Hold the tube horizontally and scratch it at a point slightly above the level of the cells. Break the tube, taking care not to spill the serum or plasma.

Hold the sampling pipet to the end of the cut tube and draw serum or plasma into the pipet. A pipet fitted with rubber tubing and a mouthpiece facilitates this step. For analysis, wipe the end of the pipet with gauze and wash the sample into a test tube containing some distilled water. Continue sampling from the tube as desired.

For sampling the packed cells, cut away the sealed end as close to the cement as possible. The tube containing the packed cells is then open at both ends and is ready for sampling. The technic is the same as that for serum and plasma.

PROTEIN

Wash 0.01 ml. of plasma into a test tube marked at 2 ml. and containing 0.5 ml. of water. Add 1 ml. of biuret reagent, incubate at 37°C. for 10 minutes, and add water until the solution reaches the mark. After mixing, read in a colorimeter with a 54 filter against a blank consisting of 1 ml. of distilled water mixed with 1 ml. of biuret reagent. For the standard, wash the same amount of standardized serum from the same pipet used for the unknown into 0.5 ml. of water. Add 1 ml. of biuret reagent and treat as for the unknown.

$$\text{Calculation.} — \frac{\text{Reading of unknown}}{\text{Reading of standard}} \times \text{per cent protein in standard} = \text{per cent protein in unknown.}$$

NONPROTEIN NITROGEN

Wash 0.02 ml. of plasma into 0.2 ml. of water. Rapidly blow in 0.5 ml. of 10 per cent trichloroacetic acid. Mix and let stand for a few minutes and then centrifuge for 5 minutes at 2,000 r.p.m. Pour into a second tube and transfer 0.5 ml. to a Pyrex test tube which has been marked at 4 ml. Add 0.1 ml. of digestion mixture and place the tube on a hot plate at a 10-degree angle with the horizontal. Maintain the plate at medium heat until the water has boiled off, then raise the temperature to high until the mixture is clear. After cooling, mix with 1 ml. of water and add 1 ml. of Nessler's reagent by pouring against the wall of the tube. Mix, dilute to the 4-ml. mark, and read with a 44 filter against a blank consisting of 0.4 ml. of 10 per cent trichloroacetic acid and 0.1 ml. of the digestive mixture. Treat as for unknown.

Standard: 1.0 ml. of dilute nitrogen standard (5 μg/ml.) mixed with 0.1 ml. of digestion mixture and 1.0 ml. of Nessler's reagent. Make this up to the 4.0 ml. mark with distilled water.

$$\text{Calculation.} — \frac{\text{Reading of unknown}}{\text{Reading of standard}} \times 35.1 = \text{mg. of nonprotein nitrogen in 100 ml.}$$

BLOOD SUGAR

Byrd's modified sugar tubes, graduated at 1-ml. and 6.25-ml. levels, and a Byrd collecting and mixing pipet are used.

Into a dry Byrd pipet fitted with rubber tubing and a mouthpiece draw 10 per cent potassium oxalate or heparin to slightly above the 0.1-ml. graduation and expel; the thin film remaining is sufficient to prevent coagulation of blood. Draw blood from a finger puncture to the 0.1-ml. graduation. Wipe the tip of the pipet. Insert the pipet into a 5-ml. centrifuge tube and expel the blood. Draw N/12 sulfuric acid into the pipet to the 0.8-ml. graduation. Shake the mixture, expelling acid into the blood, and mix until hemolysis is complete. Add 0.1 ml. of 10 per cent sodium tungstate and mix. Let stand for 5 minutes, then centrifuge at 1,500 r.p.m. for 5 minutes. Draw 0.5 ml. of the clear supernatant solution, expel into the Byrd sugar tube, add 0.5 ml. of alkaline copper tartrate, and mix

by shaking it laterally. Place in boiling water for 8 minutes; then cool for 3 minutes in running water. Add 1 ml. of phosphomolybdic acid and put the tube back in boiling water for 5 minutes; cool as before. Dilute to the 6.25-ml. mark with distilled water; then mix by inverting the tube. Read in the colorimeter against the standard or calibration curve. Use a blue filter.

CHLORIDE

Using a calibrated constriction pipet, wash 0.01 ml. of plasma into 4 drops of water. Add 2 drops of 0.07 nitric acid and 1 drop of symmetrical Diphenylcarbazone reagent. Titrate with 0.005 N mercuric nitrate solution made up in 0.3 per cent nitric acid with a Rehberg buret. Add the mercuric nitrate in small amounts below the level of the solution to be titrated, shaking after each addition.

A standard is run by measuring out 0.1 N sodium chloride into 0.1 ml. of water from the same pipet used for measuring the plasma, adding 2 drops of 0.07 nitric acid and 1 drop of the indicator. The procedure is then the same as for the unknown.

$$\text{Calculation.—} \frac{\text{Titration of unknown}}{\text{Titration of standard}} \times 100 = \text{mEq./L. of chloride.}$$

CASE REPORTS

Case No. 1. An elderly female suffered from diabetes and myocardial failure. This patient was comatose when admitted to the hospital and had been unable to retain food for several days. Her veins were sclerosed to the extent that it was impossible to find veins that would enable us to draw blood several times a day. By obtaining blood from her fingertip and using micromethods we were able to make adequate laboratory tests without great inconvenience or pain to the patient.

Laboratory findings were: blood sugar 480 mg. per 100 ml., chloride 210 mg./100 ml., carbon dioxide 38 vol. per cent, sodium 125 mEq./per L., protein 4.2 grams per 100 ml., erythrocytes 3,600,000, hemoglobin 7 grams, and hematocrit reading 31 per cent. Treatment was with plain and NPH U-80 insulin, chlorides, and protein. Chemical analyses were repeated at short intervals until the electrolyte balance was established and blood sugar approached normal levels.

Case No. 2. A premature infant whose delivery was calculated to have occurred at 7 months lost weight rapidly after birth. There was some icterus. Laboratory findings were: chlorides 108 mEq./per 100 ml.; protein 5.1 grams per 100 ml., blood sugar 68 mg. per 100 ml., carbon dioxide 50 vol. per cent, hematocrit reading 46 per cent. Normal saline was given subcutaneously and at a later date, a 30-ml. mixture of equal parts of glucose and normal saline. Anemia developed and was treated by administration of whole blood.

It is impossible in this paper to give detailed descriptions of all the ultramicrochemical technics used in our laboratory. We hope to prepare another communication that will include most of them.

The advantage of rapid and accurate chemistry in which very small amounts of blood are used is readily appreciated by the clinician. In severe diarrhea of infants, shock, heat prostration, shock resulting from burns and hemorrhage, rupture of the appendix with excessive vomiting, and salt depletion resulting from a low salt diet, rapid determination of metallic elements has aided in prompt diagnosis and treatment. Electrolyte balance can be maintained with precision.

We feel that the patients described here and similar patients have benefited by use of these methods, and all who have attempted to obtain an adequate sample of blood from the sclerosed and thrombosed veins of the aged and the tiny threadlike veins of infants should agree that the use of small samples taken from the finger or heel is easier on the patient, the doctor, and the technologist.

SUMMARY

Ultramicrochemical technics in use in the clinical laboratory have been simplified and can be performed by the well qualified technologist. Technics for determination of protein, nonprotein nitrogen, blood sugar, and chlorides have been described. The method for sampling of specimens has been given. Some conditions in which rapid chemical determination are essential to diagnosis and treatment have been listed, and two short case reports illustrating the value of ultramicrochemical technics have been included.

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THE MEDICAL SCIENCE SPECTRUM

As one studies the pattern of research activities in the medical and biological sciences, it becomes apparent that while a great deal of progress is being made toward relief or amelioration of the effects of diseases, we are not making the same progress toward understanding of the basic underlying causes of disease. This is particularly true for the chronic illnesses. I raise this point only to emphasize the continuing need for fundamental studies which will yield the knowledge with which we can achieve the ultimate goal—prevention.

By these fundamental studies, I am referring, in part, to the clinical and laboratory investigations which are traditionally thought to be the way to establish causation. But I am also referring to the opposite end of the research spectrum—to those studies involving man in his environment, both normal and abnormal. If medical science applies the knowledge and techniques of epidemiology, statistics, economics, sociology, anthropology, and related fields to these fundamental investigations, it may find that such fields have as much potential for identifying the factors in disease causation as the clinical and laboratory studies.—C. J. Van Slyke, "The March of Medical Science," 1955 National Health Forum.

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LOS ANGELES, 1955

The Fifty-Ninth Annual Convention of the American Osteopathic Association booked for one of the world's great cities will be in many ways our profession's most distinctive national meeting.

The convention extends from July 5 to July 22—actually to July 24 when the meetings of the Academy of Applied Osteopathy and its affiliate, the Osteopathic Cranial Association, are concluded.

Doctors will register for the entire convention period but select the particular sessions which they wish to attend. If they elect some one of the instruction courses they will plan to be in Los Angeles July 5; if they plan only to attend the teaching sessions, they should be in Los Angeles not later than July 18.

Never has the profession been so well informed about its national convention. On February 10, 1955, every A.O.A. member was sent from Chicago by first class mail a copy of the complete program. If any of our readers did not receive this material, it will be forwarded at once upon postcard request.

Readers will find the entire convention program beginning on page 565 of this issue. It will repay careful study.

Advance registration, always a barometer of attendance, has assured the California Osteopathic Association that the profession is responding heartily to its plans.

An entirely new generation of osteopathic physicians will meet in Los Angeles, since the last A.O.A. convention held there was in 1922. There is so much that is unusual about the 1955 convention that only the most valid reasons should prevent anyone from attending.

SALK POLIOMYELITIS VACCINE

The Francis report of April 12 on the question of the effectiveness of the Salk poliomyelitis vaccine was packed with all the drama that modern communication can command. The attendant publicity bespoke skilled planning by the National Foundation for Infantile Paralysis, even to the release of the report on the tenth anniversary of the death of Franklin D. Roosevelt, its founder. The drama was not manufactured; it was inherent in the gift—a two-way gift. The people of the United States gave most generously to the entire polio fight, that their children might be spared the ravages of one of the communicable diseases still unconquered; the gift has been returned to them with a reasonable promise of eventual victory over the affliction. Only the cynical would fail to see the entire battle against polio as an example of democracy, successful in action when wisely and strongly directed.

The Francis report as presented to the public through the medium of one of the better and more popular television programs was a model of restraint, although it was decisively affirmative. Last year's mass trial proved to be more than 80 per cent effective.

According to Dr. Hart Van Riper, medical director of NFIP, it seems probable that enough vaccine will be available by June 30 to immunize more than 30 million children. It does not seem likely that that many will seek the vaccine, but if use of the vaccine reduces the incidence of the disease by only 50 per cent, the result can be considered as a victory for preventive medicine within the traditional and correct meaning of that term. The April 12 announcement in reality was that of a battle won in a war which will have to be waged over a considerably longer period—experience has shown that it takes as many as 15 years before a perfected vaccine actually wins full acceptance in the United States.

This single event—the verdict on the poliomyelitis vaccine—accompanied by a tremendous fanfare of publicity should be contrasted with an event that occurred in 1798 when Edward Jenner, general practitioner in the small village of Berkeley, England, published his "Inquiry" on vaccination against smallpox. He had done his first vaccination on one William Phipps, 2 years before, May 14, 1796. One need not say that Jenner's approach to a problem much more serious in its totality than that of polio was one of the earliest exhibitions of a principle of scientific method. The occasional genius of Jenner's type could get no foothold in hospital, university, or laboratory then, nor for long thereafter. Without attempting to detract from today's achievement of Jonas Salk and from that of the many who are beholden to each other, the victory of Jenner, isolated in time, is little less than awe-inspiring.

The private and public groups that have worked together to make April 12, 1955, a memorable day in medical history are many. Back of these groups is the achievement not of one scientist but many. It is correct to credit Dr. Jonas E. Salk, research professor in bacteriology and director of the Virus Research Lab-

oratory at the University of Pittsburgh, with the development of the polio vaccine currently under study. He—with others—also classified all known strains of polio virus into three types.

Among the scientists who were leaders in the entire research project, the following should be mentioned: Dr. William McD. Hammon, University of Pittsburgh epidemiologist, who directed the gamma globulin field trials in 1951-1952 and showed that temporary prevention of polio paralysis could be achieved by raising the polio antibody level in the bloodstream, thus suggesting a way by which polio could be attacked; Dr. John F. Enders, Harvard University, who demonstrated the growth of polio virus in non-nervous tissue cultures in test tubes, thus freeing researchers from total reliance on monkeys; Dr. Dorothy Horstmann, Yale University, and Dr. David Bodian, Johns Hopkins, who, working independently, simultaneously discovered the presence of the polio virus in the bloodstream, confirming that the disease could there be intercepted by vaccine-stimulated antibodies; Dr. Thomas K. Rivers, director of the Rockefeller Institute for Medical Research, who serves as chairman of the Vaccine Advisory Committee of the National Foundation of Infantile Paralysis; and Dr. Hart E. Van Riper, medical director of NFIP, who assumed full medical responsibility for the 1954 trials of the Salk vaccine. Back of the immediate time-related contribution of these men are those of many others whose work would have been impossible if Karl Landsteiner, in Vienna in 1909, had not identified polio as a virus and showed that it could be transmitted to monkeys. This search for truth has not been as smooth as this sketch might suggest, nor will the progress of further polio research proceed uninterruptedly.

Medical scientists know that it will take a number of years before many of the related problems on the period of effectiveness, the dosage, and the number and interval of inoculations are fully solved. The question of whether or not a dead polio vaccine is as good as one that is feebly alive has yet to be answered. Is revaccination every 2 or 3 years of a tremendous body of people a practical thing? No scientist claims to see the polio problem and its solution in its totality. Much less do practitioners know the answer, although many will assume they know. Newspapers, magazines, radio, and television will continue to point out that this achievement is another "victory" for "medicine." Victory it is, but one that poses problems and raises questions concerning the role of medicine in relation to society. The polio story, as told to physicians generally and to the public, typifies the journalistic approach to almost all issues, and certainly to medicine. The discovery and development thus far of the Salk vaccine is a momentous event and an achievement of the first order—another triumph of etiologic medicine. Is the discovery—and others akin to it—of such significance as to embrace all that is pertinent to the comprehension, diagnosis, cure, and control of disease? Those among medical scientists, medical educators, physicians, and the informed public who raise such questions (and they are few) are suspect as crabbed critics and are quite totally misunderstood. If they are of the osteopathic school they are regarded as cranks, cultists, or, at best, armchair philosophers. But a question remains to plague thinking men—what occupies the central position in medicine? Is it the position which the journalist accepts as central? Or does the entire philosophy of medicine—or its absence—need to be reexamined?

ILLINOIS SUPREME COURT DIRECTS CHICAGO COLLEGE OF OSTEOPATHY APPROVED FOR FULL PRACTICE RIGHTS

The Illinois Supreme Court on April 19 directed the Illinois Department of Registration and Education to approve the Chicago College of Osteopathy as a school "whose graduates are eligible to take the examination for a license to practice medicine in all its branches." This decision culminates over 30 years of legal and administrative efforts of the osteopathic profession in Illinois to make osteopathic physicians eligible for the same rights and privileges which, as the Illinois Supreme Court recognized in its decision, doctors of osteopathy possess in 31 other states, the District of Columbia, and the Territory of Hawaii. The Illinois law contains other statutory requirements, including an approved internship, as a prerequisite to full licensure.

The court reviewed the legal history of the profession in the state including one of its earlier decisions rendered in 1923 which held the Medical Practice Act of 1899 unconstitutional because under it osteopathic physicians could not be licensed to practice surgery. For 20 years after the present Medical Practice Act was enacted in 1923 the Department refused to issue regulations and then did so "only after an original mandamus suit was begun by the plaintiff college." The present proceeding which has resulted in this decision was initiated in 1949 when the Chicago College of Osteopathy formally applied for approval to the Department of Registration and Education. While in name the Department of Registration and Education was the defendant in the legal action which resulted from the application of the college, the actual administration of the law is performed by a Medical Examining Committee composed of five doctors of medicine.

The College in April, 1950, was denied approval upon six grounds. In June, 1954, the Illinois Appellate Court set aside these six grounds as either discriminatory or illegal. The Department then appealed to the Illinois Supreme Court. The College has long been approved in the state for qualifying graduates for a license to treat human ailments without the use of drugs and operative surgery. The application filed in 1949 requested that the approval be extended to include those subjects not covered under that approval, namely, materia medica, therapeutics, surgery, obstetrics, and theory and practice. The Supreme Court has held that the Chicago College of Osteopathy "teaches materia medica, therapeutics, surgery, obstetrics, and theory and practice, and its instruction in those subjects parallels that given in approved medical institutions." Heretofore only medical colleges granting the degree Doctor of Medicine and approved by the American Medical Association have been approved by the Department of Registration and Education. Section 20 of the Medical

Act prohibits discrimination and the court held that the Medical Examining Committee had violated this section in making its findings and in denying the college approval.

The case involved the question of whether the Chicago College of Osteopathy maintains the same educational standards as medical colleges whose graduates now can be licensed to practice medicine in all its branches in Illinois. These colleges are the some eighty schools approved by the American Medical Association. To this issue, the court stated:

> The undisputed evidence in this record is that the instruction given at the plaintiff college on these subjects [materia medica, therapeutics, surgery, obstetrics, and theory and practice] is equal to that given in colleges approved by the Department, considered both quantitatively (hours devoted to subject, textbooks used, etc.) and qualitatively (teaching ability of the faculty, etc.) Indeed, apart from the failure to hold unlimited licenses in Illinois, the background, education and ability of the heads of departments, as well as the remainder of the faculty, are not said to be or demonstrated to be in any way inferior to that of men who staff colleges which have received departmental approval.

The court therefore ordered the case remanded to the Department with directions to "expeditiously" determine whether any changes have occurred subsequent to the time the case began which might justify withholding approval. This determination was ordered to be made with the object of carrying out the manifest intention of the legislature prohibiting discrimination as elaborated upon in the court's decision.

This decision should be a forerunner of a new day for osteopathy in the State of Illinois. The decision doe not solve all the problems of the profession in the state, but should serve as a legal foundation upon which the profession can rely in building for the people of the state the same complete public health service program that the profession in other states, not harrassed by long practiced unlawful discrimination, has been able to develop for their peoples.

The decision in full will be printed in the June JOURNAL.

MILTON MCKAY
General Counsel

Notes and Comments

Subluxation.—

An article which appeared in the January, 1955, issue of *Acta Radiologica* is called to our attention by C. D. Ogilvie, D.O., radiologist of the Stevens Park Osteopathic Hospital, Dallas, Texas. The article deals with a mechanical cause of headaches, suggesting discovery of a new etiologic factor. The paper is "Subluxation and Deformation of the Cervical Apophyseal Joints, A Contribution to the Aetiology of Headaches," by Akos Kovacs. This excerpt constitutes the summary:

> The upper articular processes of the cervical vertebrae frequently become dislocated and compress the vertebral artery and the accompanying sympathetic nerve against the border of the foramen of the transverse process above. Bilateral or unilateral headaches . . . may result. These headaches cease while the subluxation is being reduced by anteflexion traction of the head. A film taken during manipulation shows that the articular process has been removed from the transverse process. Similarly, inflammatory or degenerative changes in the small joints resulting in widening of the articular process may, by extension below the transverse process, cause contraction or circulatory disturbance of the artery and consequent headaches.

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"Arteriosclerosis Studies".—

This title heads a research progress report in the March, 1955, *Public Health Reports*, a monthly publication of the Public Health Service often recommended in this column as required reading for those physicians who wish to keep abreast of medical trends. The report as published is drawn from an original paper by Dr. Murray Goldstein, summarizing the reports of progress in arteriosclerosis research supported by grants of the Public Health Service. Dr. Goldstein prepared the paper for the National Advisory Heart Council. In its original form it afforded detailed and documented accounts of research strides; in its *PHR* form it affords a glimpse of the general scope of research in one of the more important fields of modern medicine. Since the published paper itself is a tight compression of the information in the original report, no attempt at further abstracting will be made here. Our readers can secure a single copy of the issue containing the paper by ordering it from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. *PHR* by subscription is $4.25 a year.

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Our Health Future.—

The march of medical science—"a hard, realistic appraisal of our health future"—was both the title and the subject of an important address delivered at the recent Thirty-Fifth Annual Meeting of the National Health Council in New York City, by C. J. Van Slyke, M.D., Associate Director, National Institute of Health. Dr. Van Slyke was conservative in his predictions: vaccines effective in the prevention of poliomyelitis (the polio report had not been released at the time), influenza, and minor upper respiratory infections including the common cold; major advances against heart disease, including drugs to control hypertension, and some yet unknown means to control atherosclerosis; improvements in cancer diagnosis and its treatment; new drugs useful in the management of mental illness; and natural and synthetic drugs useful in the treatment of arthritis and allied diseases. He expects fewer advances in the management of neurologic disorders, particularly multiple sclerosis; cerebral palsy; and muscular dystrophy.

That the medical and biological sciences have made a great deal of progress in the relief or amelioration of the effects of diseases through their pattern of research Dr. Van Slyke accepts as the obvious; he counters with the statement that "we are not making the same progress toward understanding the basic

underlying causes of disease." He raises this point to emphasize the continuing need for fundamental studies.

The speaker referred to the tendency of medical science to concentrate on "progressively smaller things." With studies first at the cellular level and now at the subcellular, the dimension of scientific study has been reduced from microscopic to submicroscopic. "I stress, rather," said Dr. Van Slyke, "that it is time for us to also give emphasis to the study of man as a 'supramacroscopic' organism, if you will —and to study the whole man in relation to other men and to the environment in which they live."

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Under Osteopathic Auspices.—

The point of view expressed by Assistant Surgeon General Van Slyke relates itself to the discussion of osteopathic research that made up the agenda for the third special meeting of the Foundation for Research of the New York Academy of Osteopathy, held in New York City, April 3-4. Among those present were selected representatives of each of the osteopathic colleges including the presidents of five, the chairman and the secretary of the Bureau of Research of the American Osteopathic Association, the Editor of the A.O.A., and officers of the Foundation. Dr. Kenneth Riland, its president, acted as the chairman of the meeting. Murray Goldstein, D.O., of the Grants and Training Branch of the National Heart Institute, U. S. Public Health Service, attended the sessions as an observer.

The meeting made clear the concern of each osteopathic college with research, either through the unfolding of a program, the conduct of one or more research projects, or with developmental plans for a future program. Generally the discussion revolved around the purpose and sphere of research under osteopathic auspices. It was pointed out that medical research generally is "etiologically" motivated, and that such research covers a vast field: a search for a specific cause of a specific disease; hence, a specific disease, a specific etiologic agent, and the hope of a specific therapy represents the approach of old-school medicine to research. Such research is granted as being useful and productive, but definitely and fundamentally restricted.

Emphasis was laid on the need for an understanding of a basic, general disease process, which from the osteopathic view is most commonly initiated in somatic (musculoskeletal) structures. It seemed to many who were present that osteopathic research projects and programs ought to contribute to the disclosure of the primary nature of such disease process from which may emerge an improved system of detection, diagnosis, therapy, and prevention. Before such practical advances could be achieved, however, it was agreed that osteopathic research must be fundamental in character in order to secure the reservoir of basic information needed by the profession in its attempt to meet the urgent, unanswered health problems facing society today. Research under osteopathic auspices needs no apologia if it is based upon such a premise.

Truth is not sectarian, it cannot be stolen, and it is an emergent thing. What our profession has conceived of as "osteopathic" can be so held, only as long as we validate our "claim", by a continuing original contribution to man's knowledge of health and disease. In the address referred to in the above note, Dr. Van Slyke spoke of a challenge of medical science as one to "achieve a more effective linking of institutions and agencies and organizations which together make up the health resources of our Nation." Increasingly, the osteopathic profession is being given an opportunity to coordinate its efforts and to cooperate with other agencies. That, too, is a challenge, and certainly one in the field of research under osteopathic auspices.

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Low-Back Pain and Its Treatment—By Manipulation.—

"Clinical Evaluation of Low-Back Pain and Its Treatment," by John McM. Mennell, M.B., B.Ch., is an original article which appeared in the February, 1955, issue of *Archives of Physical Medicine and Rehabilitation*, the official journal of both the American Congress and the American Society of Physical Medicine and Rehabilitation. The paper should be of particular interest to many of our readers. Dr. Mennell is the Director of Medical Services, Woodrow Wilson Rehabilitation Center, Fisherville, Va. He is the son of James Mennell, M.D., the well-known British author of several texts on joint manipulation.

The article points to the disk lesion as one, in the author's belief, which may be directly responsible for symptoms in less than 1 per cent of low-back pain. He epitomizes the disk syndrome differentially, saying that "The fashionable disc is an untenable theory." He emphasizes the fact that disk symptoms are directly related to disk prolapse, in itself an extradural spinal tumor which, if clearly diagnosed, is to be treated by removal or decompression by surgery.

Mennell presents a ". . . detailed method of clinical examination by which a symptom of low-back pain may be broken down to the discovery of evidence of a single synovial joint dysfunction which may be the primary cause of symptoms. . . ." By means of two diagrams and a series of photographs the rationale of his suggested examination is made clear. The methods of examination are among those commonly known to osteopathic physicians. Wisely, he stresses the fact that no examination for low-back pain is complete without a rectal examination. The following statements are drawn directly from the article's "Conclusion:"

. . . It is useless to prescribe therapy to alleviate secondary changes if the primary cause is overlooked. . . . It is inconceivable that heat, massage or electrical treatment can directly affect primary joint dysfunction. . . . The logical way to restore joint function is by the use of manipulation. . . .

. . . the science and art of manipulation depend upon a knowledge of the range of individual joint movement not commonly taught in the medical curriculum . . . and a technic which can only be learned from practice.

If manipulation is prescribed as a therapy it should be possible to predict its outcome as confidently and with as little margin of error as a good surgeon can, with confidence, predict that an operative procedure he recommends will relieve the symptoms for which it is performed.

. . . It is suggested that in cases in which there is primary joint dysfunction any treatment which does not include the use of manipulation to restore function can at best only be described as treatment by trial and error. This is bad medical

practice. Yet it would be worse practice to include manipulative therapy unless the operator has adequate training in technic which, in my opinion, takes at least 6 months to learn [*sic*]. . . .

The successful treatment of pain arising from joints in general, and in the spine in particular, depends on one's ability to diagnose accurately joint dysfunction (especially in the range of joint play). . . .

A footnote to the paper suggests that reprints can be obtained by writing directly to the author.

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Medical Research.—

The naming of Anton J. Carlson, M.D., as Honorary President for Life of the National Society for Medical Research has called the attention of informed people to the varied contributions made to medical science by this world-famed physiologist. Since 1945 Dr. Carlson has given much of his time to the formation and development of NSMR and its program to bring the truth about medical research, its methods, and its needs to the public. The National Society for Medical Research, begun as an experiment in public education, has proved the worth of developing public understanding, because thereby it has gained wide public support. Its chief role has been to combat the antivivisection cult and currently is to support legislation to provide pound animals for research. Active leadership of NSMR has been given over to Lester Dragstedt, M.D., chairman of the department of surgery of the University of Chicago.

The National Antivivisection Society in America has little mass support. However, it represents a danger to unhampered medical research because of its adverse influence upon the humane societies that make up the American Humane Association and because of its cultivation of wealthy cultists. Moreover, antivivisectionists could develop a large membership in the U.S.A. as they have in Great Britain or as they did in Germany during the Hitler regime. Recently the Royal Society for the Prevention of Cruelty to Animals and the Antivivisection Leagues in Britain attempted to interfere with the shipment of monkeys to laboratories in the United States—the main route from India lies through the London airport through which, according to reports, more than 100,000 monkeys passed last year. Public sentiment throughout the world can affect animal research in this country.

National Society for Medical Research has one test for an antivivisectionist: Is he trying to improve the conduct of animal experimentation or trying to hamper or eliminate it? Any person or organization that fails this test is antivivisectionist by NSMR standards. Osteopathic physicians should advise patients interested in the humane movement that there should be no conflict between those whose purpose is to prevent cruelty to animals and those who must use animals to advance medical science. The American Osteopathic Association is a member agency of the National Society for Medical Research. The success of the Salk anti-polio vaccine points up sharply the value of NSMR activities and makes it possible for doctors to inform patients of the issues at stake. Community-minded citizens—and all physicians—should know the attitude of their local humane society; these groups differ widely if they are antivivisectionist-dominated.

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THE OKLAHOMA VISUAL CARE ACT

On March 28, 1955, the United States Supreme Court rendered a decision in a case that had been appealed from a special three-judge Oklahoma Federal District Court decision. The District Court decision had held certain parts of the Act unconstitutional because they were in violation of the United States Constitution. The legislature of Oklahoma enacted the Visual Care Act in 1953. Not referred to either in the District Court or Supreme Court decision was a provision of the Visual Care Act stating that the Act was not to affect the status of persons licensed to practice under the Osteopathic Practice Act.

The Supreme Court decision is set out in full below because it indicates the present attitude of the Court toward regulations enacted by a state legislature affecting or related to the public health. The brief discussions pertaining to application of the Due Process Clause and Equal Protection Clause of the U. S. Constitution to the statutory provisions in question will dispel any beliefs that the Constitution is a bulwark against any and all unwise, wasteful, or unneeded state legislation. It is for the legislature, the court said, to balance the advantages and disadvantages of new requirements in the health field, and for protection against laws which are improvident or out of harmony with a particular school of thought recourse must be sought by the people at the polls and not from the courts.

SUPREME COURT OF THE UNITED STATES
Nos. 184 and 185—October Term, 1954.

Mac Q. Williamson, Attorney General of the State of Oklahoma, *et al.*, Appellants,	
184 v.	
Lee Optical of Oklahoma, Inc., *et al.*	On appeals from the United States District Court for the Western District of Oklahoma.
Lee Optical of Oklahoma, Inc., *et al.*, Appellants,	
185 v.	
Mac Q. Williamson, Attorney General of the State of Oklahoma, *et al.*	

(March 28, 1955)

MR. JUSTICE DOUGLAS delivered the opinion of the Court.

This suit was instituted in the District Court to have an Oklahoma law (59 Okla. Stat. Ann. SS 941-947) declared unconstitutional and to enjoin state officials from enforcing it (28 U.S.C. SS 2201, 2202, 2281) for the reason that it allegedly violated various provisions of the Federal Constitution. The matter was heard by a District Court of three judges, as required by 28 U.S.C. S 2281. That court held certain provisions of the law unconstitutional. 120 F. Supp. 128. The case is here by appeal, 28 U.S.C. S 1253.

The District Court held unconstitutional portions of three sections of the Act. First, it held invalid under the Due Process Clause of the Fourteenth Amendment the portions of S 2 which make it unlawful for any person not a licensed optometrist or ophthalmologist to fit lenses to a face or to duplicate or replace into frames lenses or other optical appliances, except upon written prescriptive authority of an Oklahoma licensed ophthalmologist or optometrist.[1]

An ophthalmologist is a duly licensed medical officer who specializes in the care of the eyes. An optometrist examines eyes for refractive error, recognizes (but does not treat) diseases of the eye, and fills prescriptions for eyeglasses. The optician is an artisan qualified to grind lenses, fill prescriptions, and fit frames.

The effect of S 2 is to forbid the optician from fitting or duplicating lenses without a prescription from an ophthalmologist or optometrist.

In practical effect, it means that no optician can fit old glasses into new frames or supply a lens, whether it be a new lens or one to duplicate a lost or broken lens, without a prescription. The District Court conceded that it was in the competence of the police power of a State to regulate the examination of the eyes. But it rebelled at the notion that a State could require a prescription from an optometrist or ophthalmologist "to take old lenses and place them in new frames and then fit the completed spectacles to the face of the eyeglass wearer." 120 F. Supp., at 135. It held that such a requirement was not "reasonably and rationally related to the health and welfare of the people." Id., 136. The court found that through mechanical devices and ordinary skills the optician could take a broken lens or a fragment thereof, measure its power, and reduce it to prescriptive terms. The court held that "Although on this precise issue of duplication, the legislature in the instant regulation was dealing with a matter of public interest, the particular means chosen are neither reasonably necessary nor reasonably related to the end sought to be achieved." Id., 137. It was, accordingly, the opinon of the court that this provision of the law violated the Due Process Clause by arbitrarily interfering with the optician's right to do business.

We think the due process question is answered in principle by *Roschen v. Ward*, 279 U.S. 337, which upheld a New York statute making it unlawful to sell eyeglasses at retail in any store, unless a duly licensed physician or optometrist were in charge and in personal attendance. The Court said, ". . . wherever the requirements of the Act stop, there can be no doubt that the presence and superintendence of the specialist tend to diminish an evil." Id., 339.

The Oklahoma law may exact a needless, wasteful requirement in many cases. But it is for the legislature, not the courts, to balance the advantages and disadvantages of the new requirement. It appears that in many cases the optician can easily supply the new frames or new lenses without reference to the old written prescription. It also appears that many written prescriptions contain no directive data in regard to fitting spectacles to the face. But in some cases the directions contained in the prescription are essential, if the glasses are to be fitted so as to correct the particular defects of vision or alleviate the eye condition. The legislature might have concluded that the frequency of occasions when a prescription is necessary was sufficient to justify this regulation of the fitting of eyeglasses. Likewise, when it is necessary to duplicate a lens, a written prescription may or may not be necessary. But the legislature might have concluded that one was needed often enough to require one in every case. Or the legislature may have concluded that eye examinations were so critical, not only for correction of vision but also for detection of latent ailments or diseases, that every change in frames and every duplication of a lens should be accompanied by a prescription from a medical expert. To be sure, the present law does not require a new examination of the eyes every time the frames are changed or the lenses duplicated. For if the old prescription is on file with the optician, he can go ahead and make the new fitting or duplicate the lenses. But the law need not be in every respect logically consistent with its aims to be constitutional. It is enough that there is an evil at hand for correction, and that it might be thought that the particular legislative measure was a rational way to correct it.

The day is gone when this Court uses the Due Process Clause of the Fourteenth Amendment to strike down state laws, regulatory of business and industrial conditions, because they may be unwise, improvident, or out of harmony with a particular school of thought. See *Nebbia v. New York*, 291 U.S. 502; *West Coast Hotel Co. v. Parrish*, 300 U.S. 379; *Olsen v. Nebraska*, 313 U.S. 236; *Lincoln Union v. Northwestern Co.*, 335 U.S. 525; *Daniel v. Family Ins. Co.*, 336 U.S. 220; *Day-Brite Lighting, Inc. v. Missouri*, 342 U.S. 421. We emphasize again what Chief Justice Waite said in *Munn v. Illinois*, 94 U.S. 113, 134, "For protection against abuses by legislatures the people must resort to the polls, not the courts."

Secondly, the District Court held that it violated the Equal Protection Clause of the Fourteenth Amendment to subject opticians to this regulatory system and to exempt, as S 3 of the Act[2] does, all sellers of ready-to-wear glasses. The problem of legislative classification is a perennial one, admitting of no doctrinaire definition. Evils in the same field may be different dimensions and proportions, requiring different remedies. Or so the legislature may think. *Tigner v. Texas*, 310 U.S. 141. Or the reform may take one step at a time, addressing itself to the phase of the problem which seems most acute to the legislative mind. *Semler v. Dental Examiners*, 294 U.S. 608. The legislature may select one phase of one field and apply a remedy there, neglecting the others. *A.F. of L. v. American Sash Co.*, 335 U.S. 538. The prohibition of the Equal Protection Clause goes no further than the invidious discrimination. We cannot say that that point has been reached here. For all this record shows, the ready-to-wear branch of this business may not loom large in Oklahoma or may present problems of regulation distinct from the other branch.

Third, the District Court held unconstitutional, as violative of the Due Process Clause of the Fourteenth Amendment, that portion of S 3 which makes it unlawful "to solicit the sale of . . . frames, mountings . . . or any other optical appliances."[3] The court conceded that state regulation of advertising relating to eye examinations was a matter "rationally related to the public health and welfare" (120 F. Supp., p. 140) and therefore subject to regu'ation within the principles of *Semler v. Dental Examiners, supra*. But regulation of the advertising of eyeglass frames was said to intrude "into a mercantile field only casually related to the visual care of the public" and restrict "an activity which in no way can detrimentally affect the people." 120 F. Supp., pp. 140-141.[4]

An eyeglass frame, considered in isolation, is only a piece of merchandise. But an eyeglass frame is not used in isolation, as Judge Murrah said in dissent below; it is used with lenses; and lenses, pertaining as they do to the human eye, enter the field of health. Therefore, the legislature might conclude that to regulate one effectively it would have to regulate the other. Or it might conclude that both the sellers of frames and the sellers of lenses were in a business where advertising should be limited or even abolished in the public interest. *Semler v. Dental Examiners, supra*. The advertiser of frames may be using his ads to bring in customers who will buy lenses. If the advertisement of lenses is to be abolished or controlled, the advertising of frames must come under the same restraints; or so the legislature might think. We see no constitutional reason why a State may not treat all who deal with the human eye as members of a profession who should use no merchandising methods for obtaining customers.

Fourth, the District Court held unconstitutional as violative of the Due Process Clause of the Fourteenth Amendment, the provision of S 4 of the Oklahoma Act which reads as follows:

"No person, firm, or corporation engaged in the business of retailing merchandise to the general public shall rent space, sublease departments, or otherwise permit any person purporting to do eye examination or visual care to occupy space in such retail store."

It seems to us that this regulation is on the same constitutional footing as the denial to corporations of the right to practice dentistry. *Semler v. Dental Examiners, supra*, 611. It is an attempt to free the profession, to as great an extent as possible, from all taints of commercialism. It certainly might be easy for an optometrist with space in a retail store to be merely a front for the retail establishment. In any case, the opportunity for that nexus may be too great for safety, if the eye doctor is allowed inside the retail store. Moreover, it may be deemed important to effective regulation that the eye doctor be restricted to geographical locations that reduce the temptations of commercialism. Geographical location may be an important consideration in a legislative program which aims to raise the treatment of the human eye to a strictly professional level. We cannot say that the regulation has no rational relation to that objective and therefore is beyond constitutional bounds.

What we have said is sufficient to dispose of the appeal in No. 185 from the conclusion of the District Court that that portion of S 3 which makes it unlawful to solicit the sale of spectacles, eyeglasses, lenses, and prisms by the use of advertising media is constitutional.

The other contentions urged by appellants in No. 183 are without merit.

The judgment in No. 184 is reversed.
The judgment in No. 185 is affirmed.

MR. JUSTICE HARLAN took no part in the consideration or decision of this case.

Footnotes

[1]Section 2 reads as follows:

"It shall be unlawful for any person, firm, corporation, company, or partnership not licensed under the provisions of Chapter 11 or Chapter 13 of Title 59, Oklahoma Statutes 1951, to fit, adjust, adapt, or to in any manner apply lenses, frames, prisms, or any other optical appliances to the face of a person, or to duplicate or attempt to duplicate, or to place or replace into the frames, any lenses or other optical appliances which have been prescribed, fitted, or adjusted for visual correction, or which are intended to aid human vision, or to give any treatment or training designed to aid human vision, or to represent or hold himself out to the public as being qualified to do any of the acts listed in this Section, except that persons licensed under the provisions of Chapters 11 or 13 of Title 59, Oklahoma Statutes 1951 may in a written prescription, or its duplicate, authorize any optical supplier to interpret such prescription, and who in accordance therewith may measure, adapt, fit, prepare, dispense, or adjust such lenses, spectacles, eye glasses, prisms, tinted lenses, frames or appurtenances thereto, to the human face for the aid or correction of visual or ocular anomalies of the human eye; and may continue to do the said acts on the aforesaid written prescription, or its duplicate, provided, however, that the physician or optometrist writing such prescription shall remain responsible for the full effect of the appliances so furnished by such other person. Provided that this Section shall not prevent a qualified person from making repairs to eye glasses."

Chapter 11, Title 59, Okla. Stats. 1951, provides for the licensing of ophthalmologists and other doctors. Chapter 13 provides for the certification of optometrists.

[2]Section 3 reads as follows:

"It shall be unlawful for any person, firm, company, corporation or partnership to solicit the sale of spectacles, eye glasses, lenses, frames, mountings, prisms or any other optical appliances or devices, eye examinations or visual services, by radio, window display, television, telephone directory display advertisement, or by any other means of advertisement; or to use any other method or means of baiting, persuading, or enticing the public into buying spectacles, eye glasses, lenses, frames, mountings, prisms, or other optical appliances for visual correction. Provided, however, that the provisions of this Act shall not render any newspaper or other advertising media liable for publishing any advertising furnished them by a vendor of said commodity or material; nor shall anything in this Act prevent ethical education publicity or advertising by legally qualified health groups that does not violate presently existing laws of Oklahoma, nor prevent the proper use of ethical, professional notices.

"Nothing in this Act shall prohibit the sale of ready-to-wear glasses equipped with convexspherical lenses nor sunglasses equipped with plano lenses nor industrial glasses and goggles with plano lenses used for industrial eye protection when sold as merchandise at any established places of business and where the selection of the glasses is at the discretion of the purchaser."

[3]See note *2, supra*.

[4]The court also said:

"Advertising directed exclusively at this feature of eye wear can have no deleterious effect on the public, inasmuch as it has no influence on the prospective wearer of eyeglasses, and to the present wearer (a person already examined by a licensed professional) is but a mere piece of merchandise.

"The dispensing optician, a merchant in this particular, cannot arbitrarily be divested of a substantial portion of his business upon the pretext that such a deprivation is rationally related to the public health." 120 F. Supp., p. 142.

Department of Public Relations

CHESTER D. SWOPE, D.O.
Chairman
Washington

HOOVER COMMISSION REPORTS ON FEDERAL MEDICAL SERVICES

The Commission on Organization of the Executive Branch of the Government, established under Act of Congress, approved July 10, 1953, and commonly known as the Hoover Commission, rendered its report on Federal Medical Services to Congress on February 28, 1955. The report is based on the findings of a Medical Services Task Force, set up by the Commission.

Speaking of beneficiaries of Federal health services, the report states: "About 4 million persons, mostly the active duty military personnel, are entitled to complete medical care; some 3.5 million veterans also are entitled to complete medical care for their service-connected disabilities. About 20 million people are eligible for care on a facilities-available basis. Of these about 17.5 million are veterans with no service-connected disabilities who are eligible for free hospitalization on their statement of inability to pay. About 2.9 million are dependents of military personnel, and retired military personnel make up most of the balance. In addition, about 2.5 million Federal employees are eligible for limited on-the-job health services for occupational injuries and disease."

Twenty-six Federal departments or agencies engage in one or more of these health functions. Three of these agencies—the Department of Defense, the Veterans Administration, and the Department of Health, Education, and Welfare—together account for some 90 per cent of total Federal expenditures for health activities.

ACTIVE MEDICAL PERSONNEL IN 1954

	Physicians	Dentists	Graduate Nurses
In Federal service	19,500	7,400	25,000
In state and local government services	13,500	300	69,700
Total in the United States	194,000	85,500	389,600

Thus the Federal Government employs about 10 per cent of all active physicians, 9 per cent of the active dentists, and 6 per cent of the active graduate nurses.

There were in 1953 about 19.9 million admissions to all hospitals in the country. The admissions to all Federal hospitals were 1,461,000 persons.

Among the recommendations of the Commission were the following: creation of a Federal Advisory Council of Health, consisting of members of the medical professions and lay members of distinguished records in fields other than the medical profession, to coordinate and develop over-all Federal medical policies and activities; authorize the Secretary of Defense to consolidate and re-allocate medical care responsibilities of the three departments of the Armed Services; that the Secretary of Defense strengthen the Armed Services training program for interns and residents, for other physicians and dentists on active duty, and for reserve officers not on active duty; that surplus VA hospitals be closed, and all present outstanding authorizations and appropriations for construction of additional VA general hospitals be rescinded, except those now under construction or under contract; that the statement of a veteran of his inability to pay for hospitalization for nonservice-connected disabilities be subject to verification, and that VA collect in case the statement is not substantiated; that VA outpatient care be furnished indigent veterans with nonservice-connected disabilities, but that such patients assume liability to pay in the future if they can; that the general hospital services of the Public Health Service be curtailed; that a special committee be set up to examine the policies, programs, and operations of the Food and Drug Administration with a view to eliminating activities no longer necessary; that a voluntary contributory program of medical care for civilian employees of the Federal Government on a prepayment basis and using payroll deductions be conducted through a pool of private health insurance agencies; that the Government develop for dependents of military personnel a voluntary contributory plan of medical care and hospital insurance to be conducted through a pool of private health insurance agencies, likewise for dependents of employees of the Public Health Service Commissioned Corps, Coast Guard, and Coast and Geodetic Survey; that a National Library of Medicine be established as a Division of the Smithsonian Institution; and that the proposed Federal Advisory Council of Health review the health research programs of the Federal Government, and examine means of establishing cooperative planning among Federal agencies providing psychiatric care, and encourage more research and more training of psychiatrists and workers in allied fields.

MEDICAL RESEARCH ACT OF 1955

STATEMENT
BY
DR. CHESTER D. SWOPE
CHAIRMAN

DEPARTMENT OF PUBLIC RELATIONS
AMERICAN OSTEOPATHIC ASSOCIATION
SUBMITTED TO THE SUBCOMMITTEE ON HEALTH
OF THE COMMITTEE ON LABOR AND PUBLIC WELFARE
U. S. SENATE

Re: S. 849, cited as the "Medical Research Act of 1955"
April 1, 1955

The American Osteopathic Association supports enactment of S. 849 to provide for grants-in-aid to accredited and nonprofit universities and schools of medicine, dentistry, and osteopathy, hospitals, laboratories, and other nonprofit institutions, engaged in or competent to engage in research, for the purpose of defraying the cost of construction of facilities, or the installation of equipment, needed for the conduct of research into the causes of and possible cures for crippling and killing diseases, including cancer, heart disease, poliomyelitis, nervous disorders, mental illness, arthritis and rheumatism, blindness, cerebral palsy, and muscular dystrophy.

The July, 1954, annual report of Dr. Alden Q. Abbott, chairman of the Bureau of Research of the American Osteopathic Association, contains the following significant statement:

> One of the major problems in establishing research programs in osteopathic institutions is lack of space that can be assigned for this purpose. There is also the problem of accumulation of the basic equipment to convert such space, when found, into a research laboratory. It is permissible to expand part of grant monies for major scientific equipment, but it is not permissible to make plant alterations or buy and install basic laboratory furniture and utilities. If the A.O.A. did not have to appropriate large amounts for the major support of the research programs, it could be in a position to assist the colleges in setting up essential laboratory facilities that would help attract assistance from outside granting agencies.

The American Osteopathic Association annually allocates funds to the limit of its ability for research in osteopathic institutions. Last year the allocation was $54,000. This year it is $60,000. Osteopathic college research projects have received support from the Office of Naval Research and the National Institutes of Health, but these funds are not available for construction costs, although additional space is sorely needed.

As in other medical colleges, the cancer and heart teaching grants provided to the osteopathic colleges by the National Cancer Institute and the National Heart Institute not only help tremendously to emphasize the impact of cancer and heart disease and the methods of detecting and dealing with them but help also to kindle and channel in their direction the investigative interest of students who have aptitude for scientific research. Stimulation of interest and discovery of aptitude for research must be followed by training in scientific methods.

Such training requires not only qualified supervision, but adequate laboratory space and equipment.

The Osteopathic Hospital and Clinic of New York is an example of an osteopathic institution (other than a college) which is in need of financial assistance for defraying the cost of construction of needed research facilities and equipment. A research project at the Clinic was recently approved by the National Institute of Arthritis and Metabolic Diseases, but deferred for lack of funds. On March 29, 1955, Dr. J. Marshall Hoag, Chairman of the Research Committee of the Clinic, wrote me in part as follows:

> One of our important problems is space. At present we are taking space which was previously used for treating clinic patients. The basement has also been utilized where possible, even though it is below ground and not constructed for regular occupancy. Our equipment is borrowed from the Clinic by inconvenient scheduling.

S. 849 will help to alleviate the problem of cost of construction of facilities and installation of equipment needed for the conduct of research in such cases, and stimulate additional assistance from private granting agencies.

MENTAL HEALTH BILLS

STATEMENT
BY
DR. CHESTER D. SWOPE
CHAIRMAN
DEPARTMENT OF PUBLIC RELATIONS
AMERICAN OSTEOPATHIC ASSOCIATION
SUBMITTED TO THE SUBCOMMITTEE ON HEALTH
OF THE COMMITTEE ON LABOR AND PUBLIC WELFARE
U. S. SENATE

Re: S. 724, S. 848, Title VI of S. 886, S.J.Res. 46
and H.J. Res. 256
March 30, 1955

The American Osteopathic Association wishes to go on record as interested and ready to cooperate in achieving the goals projected in the pending measures (S. 724, S. 848, Title VI of S. 886, S. J. Res. 46 and H. J. Res. 256), which include not only a comprehensive nation-wide research into and re-evaluation of our resources, methods and practices for diagnosing, treating, caring for, and rehabilitating the mentally ill, but also the devising of ways and means for better use and improvement of existing facilities and the development of new resources for combating the mental health problem.

The American College of Neuropsychiatrists (osteopathic) has long been cognizant of the need of increased clinical facilities and psychiatric personnel for the diagnosis and treatment of the mentally ill, according to Dr. Don C. Littlefield, Secretary. Dr. Littlefield writes me that the College advocates such measures as are necessary and proper to increase the number of mental health clinics throughout the country; provide adequate qualified personnel (mental health) on a full or part-time basis to the community with the object of early diagnosis and treatment of emotionally disturbed persons; and provide for research into causation of juvenile delinquency, adult crime, suicide, alcoholism and all other community problems motivated from individual and/or group maladjustment; and states that the pending bills are important steps in the proper direction.

The training and certifying of psychiatrists who are doctors of osteopathy have followed, to a great extent, the training and certifying of psychiatrists who are doctors of medicine. The specialty certifying board for doctors of medicine was founded in 1934. In 1941 the American Osteopathic Board of Neurology and Psychiatry was officially approved by the Board of Trustees of the American Osteopathic Association. It was formed by members of the American College of Neuropsychiatrists (osteopathic) which had been organized in 1938. In order to qualify for certification the candidate must be a graduate of an approved college of osteopathy, complete an internship of at least one year in an approved intern-training hospital, evidence at least three years of approved residency or equivalent special training, then practice at least two years as a specialist devoting at least 80% of his practice in the specialty field, after which he must pass appropriate examinations conducted by the specialty Board.

Organized psychiatric departments in all the colleges provide undergraduate training. However, facilities for graduate training are very limited. Commenting on this fact, Dr. Thomas J. Meyers, Secretary of the American Osteopathic Board of Neurology and Psychiatry, has written me (in response to my inquiry for an expression from him regarding the bills now pending before the Subcommittee) in part as follows:

> A positive program aimed at training a greater number of skilled professional and allied personnel is badly needed. We need more psychiatrists in our profession, but our training centers can take only a few candidates, and these are trained only because the trainers have been willing to sacrifice personal advantages without adequate compensation. . .
>
> Many of the discoveries made in this field have been made by small institutions that escape notice or consideration, and which must work under the stimulus of dedicated individuals. These bills offer promise that some assistance will now be available to them so that their contributions will become more fully developed and more widely disseminated.

It is gratifying that the bill, H. R. 5046, which passed the House on March 21 and is now pending before the Senate Appropriations Committee increases the funds available to the Mental Health Institute, particularly for training programs which may enable the Institute to extend mental health teaching grants to more medical and to osteopathic colleges.

It is the policy of the osteopathic profession and institutions to cooperate with agencies, public and private, for advancing the public health.

POLIO VACCINE LICENSED

Six pharmaceutical concerns were licensed April 12, 1955, to manufacture and distribute in interstate commerce the poliomyelitis vaccine developed by Dr. Jonas Salk of the University of Pittsburgh, the U. S. Department of Health, Education, and Welfare announced today.

The licenses were signed by Secretary Oveta Culp Hobby on the recommendation of Dr. Leonard A. Scheele, Surgeon General of the Public Health Service. This procedure is in accordance with the Regulations of the National Biologics Control Act.

Licenses were issued to the following requesting firms:
Cutter Laboratories, Berkeley, Calif.
Eli Lilly Co., Indianapolis, Ind.
Parke-Davis & Co., Detroit, Mich.
Pittman-Moore Co., Zionville, Ind.
Sharp and Dohme, Philadelphia, Pa.
Wyeth Laboratories, Inc., Marietta, Pa.

Under the National Biologics Control Act, a license for the manufacture and interstate distribution of vaccines, serums, antitoxins and similar biologic products for medical use is issuable when the manufacturer demonstrates that his products meet Federal standards as to safety, purity and potency. Such products are tested and evaluated by the Biologics Control Laboratory of the National Institutes of Health, research branch of the Public Health Service.

Dr. William G. Workman, Chief of the Biologics Control Laboratory has for the past year been in close touch with Dr. Salk and the manufacturing firms in developing standards for the vaccine. Final determination on the licensability of the vaccine was made from data which were made public by Dr. Thomas Francis, Jr., of the University of Michigan. Dr. Francis headed the Vaccine Evaluation Study which was established to review results of the tests carried on throughout the country last spring and summer by the National Foundation for Infantile Paralysis.

CORRECTION

In the article, "Facts and Fancies of Cancer Therapy," by L. Raymond Hall, D.O., published in the March JOURNAL, the total therapeutic dose of Mustargen was given as 4 mg. per kg. of body weight in divided doses in Table I on page 419. It should have read 0.4 mg. per kg. We regret the error.

Current Literature

SOFT-TISSUE TUMORS OF THE SOLE

The vagueness and dearth of knowledge about soft-tissue lesions of the foot prompted Raymond A. Allen, M.D., and others to review Mayo Clinic records of all such tumors. Their evaluation of 69 cases of plantar fibromatosis and 9 cases of malignant tumors (8 synoviomas and 1 liposarcoma) appeared in *The Journal of Bone and Joint Surgery,* January 1955.

The clinical records and follow-up letters were supplemented by tissue specimens of plantar fibromatosis from 37 patients and of malignant tissue from all malignant lesions. Plantar tumors behaved like those elsewhere in the body.

Fibromatosis was found in the plantar fascia only in 24 of the 69 patients; in the others, the fascia of both the hand and foot was involved. These patients also had Peyronie's disease; three with both palmar and plantar involvement also had knuckle pads; four (two with only plantar, and two with both palmar and plantar, involvement) also had keloids; and two patients (both with soles and palms involved) also had firm subcutaneous nodules in ligamentous tissue elsewhere. Two had had the lesion at birth, and in 24 others it was noted before age 30. It appeared oftenest during the fourth decade of life. Of the series, 43 were men. Only 27 patients had bilateral plantar involvement. In 23 cases slight to severe pain was reported, 14 experienced no pain, and the remainder made no mention of it.

Among 38 patients treated surgically 15 had recurrences after a single excision and 7 after two operations. Three or more operations were performed on 3 patients, each of whom had recurrences. Lesions reappeared within a year in most instances, sometimes almost immediately after excision. The disease, always prolonged, may last a lifetime.

Differentiation from malignant neoplasms is complicated by the occasional cellular variability, mitotic figures, and even invasive properties noted. Foot lesions accompanied by hand lesions or Peyronie's disease, or bilateral plantar lesions usually suggest plantar fibromatosis. Its rapid recurrence after excision, its recurrence in multiple nodules after a single mass has been excised, and its adherence either to the skin or to the deep structures tend also to suggest malignancy. However, metastasis from plantar fibromatosis has not been found nor has evidence that it otherwise pursues a malignant course. In this series follow-up extended over 39 years; 19 patients were followed 5 years or longer.

Case histories of the 9 patients with malignant tumors are given to show the course of the disease.

THE USE OF THE MAGNESIUM ION IN THE MANAGEMENT OF ECLAMPTOGENIC TOXEMIAS

Results of a 3-year study of treating toxemia of pregnancy in 211 eclamptic and pre-eclamptic patients with magnesium sulfate alone are reported by Jack A. Pritchard, M.D., in *Surgery, Gynecology and Obstetrics,* February 1955.

Patients in active eclamptic convulsions were given 4 grams of magnesium sulfate (the USP salt) in 20 per cent solution by intravenous infusion over a period of 4 to 5 minutes. Then 10 grams of magnesium sulfate in 50 per cent solution were equally divided and injected intramuscularly, deep into each buttock. As long as patellar reflexes remained active and the 4-hour urine output at 100 mm. or more, 5 grams in 50 per cent solution was given intramuscularly every 4 hours until delivery and usually for 24 hours thereafter. The regimen for pre-eclampsia was identical but for omission of the intravenous injection.

Absorption, distribution, and excretion of magnesium taken orally, intramuscularly, and intravenously were studied in normal and diseased persons. Magnesium concentrations in plasma, erythrocytes, cerebrospinal fluid, amniotic fluid, peritoneal fluid, and the urine were measured, as were the inulin and magnesium spaces in anuric or oliguric persons. Glomerular filtration rates, renal plasma flow, urine and serum sodium, and potassium concentrations were all measured.

The 211 toxemic patients gave birth to 221 infants, 21 of whom died perinatally. Magnesium sulfate potently and safely inhibited eclamptic convulsions in both pre-eclamptic and eclamptic patients. Its anticonvulsant action does not depend on hypotensive action nor can it be correlated with pronounced depression of the central nervous system. The patellar reflex activity would not suggest peripheral curariform action. As long as urine output and the patellar reflex were checked, no evidence of either maternal or fetal cumulative toxicity was noted. Hypermagnesemia within therapeutic range failed to inhibit uterine contractions or significantly to depress the fetus. In fact significant signs of fetal depression were never noted. Breathing and crying times were usually normal.

Just how magnesium sulfate prevents eclamptic convulsions is not known. Given parenterally, it is not confined to the extracellular fluid compartment. Although injected magnesium does cross the placenta, no significant amount enters the cerebrospinal fluid. Magnesium sulfate has no striking effect on renal plasma flow nor glomerular filtration rate despite the fact that when it is given parenterally it is excreted by the kidneys only.

STUDIES ON METACORTANDRALONE AND METACORTANDRACIN IN RHEUMATOID ARTHRITIS

Seven patients with arthritis (stages 1-4) for a range of 2½-25 years received treatment with two new synthetic steroids. A preliminary report on the antirheumatic, anti-inflammatory, endocrinologic, and metabolic effects is given by John J. Bunim, M.D., and his coworkers in *The Journal of the American Medical Association,* January 22, 1955.

Metacortandralone (30-60 mg. per day) was given every 8 hours for 2 weeks, after which the daily total was reduced 5-10 mg. at a time every 4 or 5 days until signs and symptoms reappeared. The maintenance dose—the minimum giving greatest comfort and fewest signs—ranged from 5 to 25 mg. a day. Salicylates and other antirheumatic agents were withdrawn for the test period (12-77 days).

Joints and general well-being improved significantly, immediately, and consistently, and swelling, tenderness, and feverishness of joints diminished. Functional capacity increased, and pain subsided. Whenever steroid therapy was discontinued, pretreatment signs and symptoms recurred.

Prompt and significant drops in the number of circulating eosinophils and values of urinary 17-ketosteroids were noted. Erythrocyte sedimentation rates and C-reactive protein levels returned to normal or near normal. Hematocrit, hemoglobin, and total cholesterol levels, red and white blood cell counts, and neutrophil ratios rose in several patients. Balance studies—on 2 patients—disclosed neither sodium retention nor potassium or nitrogen loss during treatment with suppressive doses until the dosage was greatly increased and uninterrupted therapy doubled from the usual 12 days to 24. On the average, serum albumin fraction rose 0.7 gram, and serum globulin fraction fell 0.9 gram per 100 cc. No glycosuria and only insignificantly higher fasting blood sugar level were noted.

Metacortandralone proved 3-4 times more effective than cortisone and 2-3 times more so than hydrocortisone in antirheumatic and anti-inflammatory potency. Proportionately, the undesirable side-effects were neither as common nor as intense and subsided promptly on reduction of steroid dosage. Subsequent studies have suggested occasional need to increase maintenance dosage after several months of continuous therapy; free choice of food seems to control the mild epigastric symptoms experienced by some, and 6-hour intervals of medication seemed preferable to 8-hour intervals.

At the time of this report metacortandracin had been given orally to 5 patients with rheumatoid arthritis, 3 of whom had been given metacortandralone previously. Preliminary studies indicate that the hormonal effects and antirheumatic effects of these two synthetic steroids are quite similar.

Book Notices

PHYSICAL MEDICINE IN GENERAL PRACTICE. Edited by William Bierman, M.D., and Sidney Licht, M.D. Ed. 3. Cloth. Pp. 798, with illustrations. Price $12.50. Paul B. Hoeber, Inc., 49 E. 33rd St., New York 16, 1952.

"Physical Medicine in General Practice" is perhaps one of the finest books in the field of physical medicine to have left the presses within recent years. The book represents the revision, by some twenty-two authorities, of what was already an outstanding text. Although the title of the work directs it to the general practitioner, the scope of the book is such as to make it valuable to physiatrists as well as other specialists. Great care has been taken by the editors in the revision; chapters have been added to cover such new fields as ultrasonics, microwave diathermy, muscle testing, and neuromuscular re-education. Care of amputees and of the victims of anterior poliomyelitis is adequately considered in new sections. New articles are devoted to the technics of manipulation which, while a standard part of the armamentarium of osteopathic physicians, are now gaining attention from practitioners of the older school of medicine. Many of these technics are described in detail, but without reference to their osteopathic sources.

The chapter on ultrasound, written by Dr. Fritz Friedland, deserves special commendation for the avoidance of both the superlative claims of its European advocates, and the nihilistic approach of some of its critics. The objectivity of this report lends added weight to some of the favorable comments made by Friedland.

The portion of the book on low voltage currents, while excellent in many ways, is quite deficient in its discussion of the rapid sinusoidal current. This current, valuable as it is in the management of the neuritides and neuralgias, has been neglected almost completely as a therapeutic agent and is considered only from the aspect of a diagnostic current.

The chapter, The Conduct of Treatments, should be required reading for every physician who makes any use of physiotherapy, either personally or through a nurse or technician. Dr. William Benham Snow, who wrote this particular section, stresses the fact, among others, that many instances of burns would have been avoided if the patient had been properly tested for sensitivity to heat and cold. This procedure should be mandatory with every patient.

In conclusion, "Physical Medicine in General Practice" fills a definite need for a text that is broad enough to be used by the student and general practitioner, and yet sufficiently detailed and authoritative to be a part of the specialized library of the physiatrist.

GLENN F ULANSEY, D.O.

ANESTHESIOLOGY. By Forty American Authors. Donald E. Hale, A.B., M.D., M.S., F.A.C.S., F.A.C.A., Supervising Editor, Head of Department of Anesthesiology, Cleveland Clinic, Cleveland, Ohio. Cloth. Pp. 756, with illustrations. Price $15.00. F. A. Davis Co., 1914-16 Cherry Street, Philadelphia 3, 1954.

A comprehensive volume such as this, with contributions by forty well-known authorities from the United States and Canada, does not allow for much uniformity in style. Much credit, therefore, is due to Dr. Hale, the supervising editor, for his excellent editing.

There occurs in the preface a sentence which cannot be too strongly emphasized, "To give anesthesia is not difficult; but to give safe anesthesia is." With this thought the reviewer agrees wholeheartedly. Throughout the text the safety factor in anesthesia is stressed.

Chapter 6, Management of the Anesthesia by Ralph T. Knight and Arthur B. Tarrow, is, to my mind, the book's most outstanding chapter, for in it is encompassed the essence of the art and science of anesthesiology. The anesthesiology resident, and no doubt many anesthesiologists, will find that the practical teaching substance in this chapter is well worth the price of the book.

In the consideration of Pentothal sodium (and this applies equally well to all of the ultrashort-acting barbiturates) occurs the admonition, "Do not use Pentothal until you are thoroughly familiar with general anesthesia and capable of overcoming any respiratory emergency." Disregard of this warning will contribute to anesthetic morbidity and mortality. All teachers of anesthesiology residents would do well to emphasize this point.

This is a complete text in that the entire field of the specialty is covered. The chapters on the physiology and pharmacology of anesthesia are well written and cover more material in this area than do the individual chapters.

This book can be highly recommended to the resident in anesthesiology, to the practicing anesthesiologist, to the part-time physician-anesthetist, and to the surgeon.

A. A. GOLDEN, D.O.

APPLIED PATHOLOGY As an Introduction to Disease and Its Control. By Charles G. Darlington, M.D., F.C.A.P., Professor of Pathology and Director of the Undergraduate Cancer Teaching Project, New York University College of Dentistry; Pathologist to Dental Service, Montefiore Hospital, N.Y.C.; Colonel-Ret. A.U.S.; Consulting Pathologist to Beekman-Downtown Hospital, N.Y.C.; formerly Pathologist to Muhlenberg Hospital, Plainfield, N.J., and Charlotte F. Davenport, R.N., B.S., Assistant Director of Nursing Service, Muhlenberg Hospital, Plainfield, N.J., With the Collaboration of Albert Segenreich, B.S., M.D., Assistant Professor of Pathology, New York University College of Dentistry; Diplomate of the American Board of Internal Medicine; Assistant Attending Physician to Beekman-Downtown Hospital, N.Y.C. Ed. 2, revised. Cloth. Pp. 500, with illustrations. Price $4.75. J. B. Lippincott Company, East Washington Square, Philadelphia 5, 1954.

This is a revision of "Introduction to Medical Science on a Basis of Pathology," which was published in 1942. Once again a physician and a nurse collaborate to produce a book that introduces medical science to the nurse by integrating anatomy, physiology, chemistry, and microbiology—all subjects in which she has received basic instruction during her student days—with her everyday care of patients.

Abundant illustrations, meaningful charts, and clarity of writing combine to provide the nursing profession with an easy-to-understand handbook on applied pathology. The book should not only introduce medical science to the nurse, but also should maintain and stimulate her interest in the subject, which is of vital concern to her.

HUMAN BIOCHEMISTRY. By Israel S. Kleiner, Ph.D., Professor of Biochemistry and Director of the Department of Biochemistry, New York Medical College, Flower and Fifth Avenue Hospitals; Formerly Associate, The Rockefeller Institute for Medical Research, New York. Ed. 4. Cloth. Pp. 746, with illustrations. Price $7.50. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1954.

Vast new horizons have come into view with great speed in the field of biochemistry. To keep up with this rapid advance, the fourth edition of this book was necessitated. As has been the case with his previous three editions, Dr. Kleiner has again produced a useful, understandable, and compact volume.

Eliminated from this edition are all concepts which have changed or have become of doubtful nature. This means that much of the text was rewritten, notably those parts dealing with blood coagulation, enzymes and coenzymes, physiologic oxidations, cholesterol metabolism, urea formation, transmethylation, and the mechanics of insulin action.

New topics included for discussion concern the dextrans, triiodothyronine, glucagon, serotonin, the carbonic anhydrase inhibitors, blood iodine, lipoic acid, and the structure of insulin and of oxytocin. Illustratively, two new photomicrographs and several new figures and diagrams have been added.

The first edition, published in 1945, aimed "to bring home to the student . . . [the] clinical aspects of chemistry without usurping any clinician's domain and without neglecting the fundamentals." Three editions later, that is still the purpose of "Human Biochemistry."